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ABSTRACT

This guide was developed in New Hampshire to assist schools in upgrading their industrial arts programs to technology education programs reflecting the state of the art in the technology education curriculum. It was developed through visits to many New Hampshire schools, as well as schools and colleges in 10 other states, and attendance at several regional and national conferences. The guide is organized in six sections. Section 1 introduces and defines technology education and states its philosophy. Section 2 provides a rationale for making the change from industrial arts to technology education. In section 3, suggestions for implementing technology education programs are made, with unit plans and models for various size schools, as well as an inservice model to assist teachers in implementing technology education. Section 4 provides the New Hampshire technology education program guide and standards; section 5 contains 56 references used for the transition to technology education project. The final section documents the research project that provided the basis for the guide. (KC)

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A Guide for Change---

Making the Transition

from
Industrial Arts

to
Technology Education

CE 052 273

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

This *Guide for Change* was developed as the result of a fully paid Sabbatical under the auspices of the *Christa McAuliffe Trust of the State of New Hampshire* by Paul Cuetara of North Hampton, New Hampshire completed during the 1987-88 Academic Year.

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A GUIDE FOR CHANGE ---

MAKING THE TRANSITION

FROM

INDUSTRIAL ARTS

TO

TECHNOLOGY EDUCATION

STATEMENT OF PURPOSE

AND ACKNOWLEDGEMENTS

FOR TRANSITION TO TECHNOLOGY

EDUCATION PROJECT

Transition to Technology Project -

A Guide to Transition

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Other inquiries relative to this project, the effort and/or process of implementing a change to Technology Education should be made in writing to: Paul Cuetara, Transition to Technology Project Director; 58 Winnicut Rd., North Hampton, New Hampshire 03862.

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Produced in North Hampton, New Hampshire, July 1988.
Revised in North Hampton, New Hampshire, December 1988

Statement of Purpose of This Guide for Change from Industrial Arts to Technology Education

This Guide to Transition is produced to serve two purposes. The first, and likely most obvious, is to assist schools in upgrading their Industrial Arts Programs to Technology Education programs reflecting the "state of the art" in Technology Education (Industrial Arts) curriculum. Curriculum in schools is by its nature a dynamic creature and a curriculum which attempts to assist the learner in making meaningful career decisions must be even more dynamic. However, this is not the case. Current research indicates that while opportunity for change has been there, it has not been grasped with acceptance by the profession.

While there are many arguments both for and against change they really are not relevant. What is relevant is that we are in a changing society and our schools must recognize that the role they play is a changing one as well. This program must accept it's role in the school as a vehicle for making this change meaningful to all students.

It is important that consideration be given to making the most effective use of teachers, facilities and equipment already existing within the school as factors of this change. A total washout of what has been ongoing is not suggested, but rather an orientation of what exists to be more meaningful to all students in the school. For many professionals this shift in focus will be an opportunity to revitalize their programs as contributing partners in the school as a whole.

The "Transition to Technology Education Project" was sponsored in part by a Sabbatical from the Christa McAuliffe Trust. This one year paid leave provided the Director, Paul Cuetara of North Hampton, New Hampshire, the opportunity to research the state of the art in Technology Education Curriculum development in New Hampshire, New England and around the country.

Activities of this project included visitations to many New Hampshire schools, as well as schools and colleges in over ten different states. Also, the Director attended several Regional and National Conferences as part of this project's activities.

Paul Cuetara, North Hampton, New Hampshire, July 1988

Special Acknowledgements

Any effort to facilitate change in education cannot occur without the contributions and support of many individuals. I would like to offer my sincere gratitude to:

- the Trustees of the Christa McAuliffe Trust for making the opportunity to work on this transition possible.

- Roland Cournoyer, State Curriculum Supervisor, Technology Education (Industrial Arts) for his continuing support, assistant and encouragement throughout the year's activities. Without his unquestioned support and loyalty I doubt that the cooperation from other fronts would have been easy to gain. As both a friend and fellow professional Roland contributed to the successful completion of this project in numerous ways, both small and large.

- Dr. Robert Andrews, Dean of Graduate Studies, Keene State College, for his assistance in initiating the movement by directing the development of the New Hampshire Guide, and for his encouragement of my efforts both during the development of my proposal and in the development of the final draft of the transition guide.

- Lyman Goding, Principal, Plymouth Area High School, Plymouth, Massachusetts (formerly Principal at Newmarket Jr-Sr High School) for his support in developing the proposal and encouragement of my efforts to take the risk. Mostly, for his teaching me that you have to be willing to work on the solution, if you are unhappy about the present state of affairs, and that your only limitations are those you place upon yourself as a professional and a person.

- John Ball, Superintendent of Schools, SAU 31, Newmarket, NH, for his unquestioning support, encouragement and interest in my opportunity to work on this project and grow as a professional educator.

- Each of the professionals at the 11 schools which worked as participants in this project. Their zeal, interest and encouragement are indicative of the excellent professional commitment of the members of our profession.

- Everyone that I interviewed, shared time with and was willing to listen, ask questions and wonder about the prospects of being a part of a significant change in education in New Hampshire and this nation. This includes the staff at the NCRVE, Ohio State, Bowling Green, Keene State, Fitchburg State, Central Connecticut, University of Southern Maine, Rhode Island College and others.

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MAKING THE TRANSITION

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TO

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SECTION A

INTRODUCTION

TO

TECHNOLOGY EDUCATION

Making the Transition from Industrial Arts to Technology Education

Industrial Arts programs in New Hampshire should be upgraded to Technology Education programs. These programs would be developed in a structure consistent with the current Industrial Arts and Technology Education Program Guide for the State of New Hampshire, 1986. To develop a model program grades 9 and 10 were selected as the most consistently similar existing in New Hampshire schools. Based on survey responses of teachers in New Hampshire there appears to be a lack of consistency in the implementation of Industrial Arts programs at the other grades in the schools. Furthur development of this effort should clearly focus on development of a more specific curriculum standards model for particularily grades 6 through 8.

The New Hampshire model Technology Education program would be for grade 9 and 10 students, both male and female, providing for opportunities and experiences in areas of:

Communication Technology
Power, Energy and Transportation Technology
Materials Processes Technology

Students would participate in modular units of study lasting typically three weeks in length, with limited exception. These units would be designed to provide all students with hands-on experiences to help them develop stronger understandings of technology in today's society. Activities would be open ended and, when possible, student directed integrating all the areas of technology as appropriate.

Program completers of this model Technology Education program would be eligible to receive a waiver of up to one math and one science graduation credit, consistent with existing policy for students enrolled in vocational education programs, toward their high school graduation. Program goals, objectives, activities and evaluation will be developed in coordination with the local Technology Education (Industrial Arts) teacher, science teacher, math teacher, guidance and local school administration. This will be accomplished by meeting the New Hampshire Standards for Approved Technology Education Programs.

Goals achieved by adoption of an approved Technology Education program have been shown to be:

1. More relevant to the career and personal development experiences for all learners in the environment.
2. Complement the academic/vocational integration of students.
3. Impact positively on potential attrition rates of students.
4. Highly cost effective providing a solution to several major educational concerns using existing resources of space, staffing, time, equipment and money.

Programs for elementary, middle, or junior high, school students would complement this proposed model by providing activities in each of the three cluster areas proportionally based on time allocated for Technology Education instruction. More traditional "craft" courses could be maintained for those students in grades 11 or 12 who wish to avail themselves of these opportunities as "elective" or for educational enrichment purposes.

The Technology Education model as presented here is based on five goals which will help to provide students:

1. Opportunities to develop problem solving skills in a hands-on activity-based program using learnings from math and science classes as well as basic communication skills.

2. An understanding of the nature of technology in our world, its uses, applications and impact on society.

3. Career and personal development opportunities and experiences relevant to the current applications of technology today.

4. Experiences working with the basic technological loop model of:
   Input - Process - Output - Feedback.

5. Leadership and personal development through student youth organization activities as an integral component.

Schools desiring to participate in this transition would evaluate their current programs using the Standards for Program Approval of New Hampshire Technology Education Programs. Initially it is recommended that a school will convert one introductory Industrial Arts course to a Technology Education course of study. Following the implementation of this unit of instruction the Advanced Technology Education course would be implemented for the second school year. At the same time, another introductory course could become Technology Education or remain traditional, providing students with an option. Students in grades 11 and 12 could elect a craft based course, or schools could investigate the option of implementing Principles of Technology as an elective in support of the foundations set through an approved Technology Education program as described above.

A Definition of Technology Education

TECHNOLOGY EDUCATION is a comprehensive action-based education program concerned with technical means, their evolution, utilization, and significance; with industry, its organization, personnel, systems, techniques, resources, and products; and their social/cultural impact.

TECHNOLOGY EDUCATION can help the student to:

* know and appreciate the importance of technology.
* apply tools, materials, processed and technical concepts safely and efficiently.
* discover and develop individual talents.
* utilize problem solving techniques.
* apply other school subjects.
* involve creative abilities and strategies.
* deal with forces that influence the future.
* adjust to the changing environment.
* become a wiser consumer.
* make informed career choices.

CRITERIA FOR A TECHNOLOGY EDUCATION PROGRAM

At all levels the program/course is based upon....

1. an organized set of concepts, processes, and systems which are uniquely technological;
2. fundamental knowledge about the development of technology and its effect on people, the environment, and culture;
3. instructional content drawn from one of more of the following areas:
   (a) communication-efficiently utilizing resources to transfer information to extend human potential;
   (b) construction and manufacturing-efficiently utilizing resources to build structures, or constructed works on site, to extract and convert raw/recycled materials into industrial and consumer goods;
   (c) transportation-efficiently utilizing resources to obtain time and place utility to attain and maintain direct physical contact and exchange among individuals and societal units through the movement of goods/materials and people;
4. assisting students in developing insight, understanding, and application of technological concepts, processes, and systems;
5. applying tools, materials, machines, processes, and technical concepts safely and efficiently;
6. developing student skills, creative abilities, positive self-concepts, and individual potentials in technology;
7. developing student problem-solving and decision-making abilities involving human and material resources, processes and technological systems;
8. preparing students for lifelong learning in a technological society;
9. activity oriented laboratory instruction with students reinforcing abstract concepts with concrete experience; and
10. a combined emphasis on "know-how" and "ability to do" in carrying out technological work.

From: Standards for Technology Education Programs 1985

PHILOSOPHY OF TECHNOLOGY EDUCATION

The creation of technology is uniquely a human endeavor and a distinguishing characteristic of our developed civilization. Technology is the application of organized knowledge and problem solving techniques. It consists of inventions, innovations and other creative developments for producing physical objects and performing technical services. Technology involves the resources, tools machines, processes and systems that are needed for satisfying the material needs and desires of people. It includes the processes of design, engineering, invention, research, experimentation, development, production and control. The development and application of technology has occurred primarily in industry, our major economic institution. Both technology and industry have provided benefits and problems for our society, culture and environment. Upon this content base, experiences in technology education are planned and implemented.

Technology education focuses on a systems approach to develop technological literacy. The systems of communication, construction, manufacturing, power and transportation provide broad content areas of study. Technology education provides a vital link in the math/science/ technology triangle to assist with understanding, living and working in our advanced technology / information era. Its interdisciplinary nature also helps students to comprehend and apply the natural sciences, social sciences and humanities.

A holistic approach is employed in technology education. Each student is actively involved in classroom/laboratory activities that develop knowledge, skills and attitudes regarding industry and technology. Emphasis is given to nuturing leadership, communication, social interaction, problem solving and manipulative skills. Personal and social growth is fostered through interaction with other students in the laboratory and in student technology education organizations. The technological method of problem solving is experienced in identifying a problem, collecting and analyzing data, generating alternatives, synthesizing a design or plan, developing a proposed product or service, and evaluating the process and the results. Throughout this educational process, the students are taught to explore avocational and vocational interests and to make wise consumer, citizen and career decisions.

The goal of technology education is for the learners to become technologically literate, and thus be able to:

- Interpret the evolution of technology and its relationship to mathematics, science, society and industry;
- Establish beliefs and values based on the impact of technology how it alters human capabilities and environments;
- Develop attitudes and abilities in the proper use of tools, processes, and resources of technological and industrial systems
- Develop creative solutions to present and future societal problems using technology; and
- Explore and develop human potential related to responsible work, leisure, and citizenship roles in a technological society.

CONTRIBUTIONS OF TECHNOLOGY EDUCATION TO THE TWELVE GOALS OF QUALITY EDUCATION

ANALYTICAL THINKING

A quality technology education program helps every student:
- Solve problems by practical application.
- Examine the benefits and risks of implementing technology.
- Analyze characteristics and determine their educational and vocational implications.

ARTS AND HUMANITIES

A quality technology education program helps every student:
- Realize creative potentials.
- Understand quality design and workmanship.
- Explore avocational activities.
- Evaluate the impact of technology on life.

CITIZENSHIP

A quality technology education program helps every student:
- Understand the management and organization of industrial enterprises.
- Develop leadership potential.
- Understand and apply parliamentary procedure.
- Function well independently with a group in a democratic system

COMMUNICATION SKILLS

A quality technology education program helps every student:
- Communicate intelligently about technology, industry and their social/cultural impact.
- Understand and interpret the language of industry and technology.
- Listen, speak, read, write and visualize in the content areas.
- Draw artistic and technical images.
- Locate and retrieve information.

ENVIRONMENT

A quality technology education program helps every student:
- Understand energy conversion, application and conservation.
- Practice conservation.
- Utilize raw materials appropriately.
- Assess the impact of technology on the environment.

FAMILY LIVING

A quality technology education program helps every student:
- Interact with technological products and people using technology.
- Perform home maintenance tasks.
- Be a better consumer.
- Select leisure activities.

HEALTH
A quality technology education program helps every student:
- Develop attitudes and habits relative to personal and environmental safety.
- Understand the potential impact of safety in the world.

MATHEMATICS
A quality technology education program helps every student:
- Apply mathematical tools to the solution of practical problems.
- Understand and utilize various measurement systems.
- Use calculations in problem solving situations.

SCIENCE AND TECHNOLOGY
A quality technology education program helps every student:
- Know the relationship between science and technology.
- Reinforce scientific concepts and principles through practical applications.
- Understand and utilize communication, manufacturing, construction, power and transportation technological systems.
- Experience and assess technology of the past.
- Forecast and prepare for future technologies.
- Pursue the technological method of problem solving.
- Apply computer science and technology.

SELF ESTEEM
A quality technology education program helps every student:
- Experience pride in quality work.
- Develop interests, values, knowledge and motor skills related to life and careers.
- Succeed in realizing his/her worth to society.

UNDERSTANDING OTHERS
A quality technology education program helps every student:
- Interact effectively with others locally, nationally and internationally.
- Understand the importance of others in our social environment.
- Realize the effects of technology on societies and cultures.

WORK
A quality technology education program helps every student:
- Explore careers in communications, manufacturing, construction, energy, power and transportation.
- Understand one's talents and interests related to his/her potential.
- Develop basic skills that apply the technology of relevant occupational clusters.
- Become flexible and responsive to technological changes in the work environment.

A GUIDE FOR CHANGE ---

MAKING THE TRANSITION

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SECTION B

WHY MAKE THE CHANGE TO TECHNOLOGY EDUCATION?

Making the Transition to Technology Education or thoughts about making a change---

Before actually writing a guide for the transition to Technology Education from Industrial Arts, it may be helpful to establish a philosophical basis for this change. Following are thoughts garnered during a year of research relative to the shift to Technology Education. Certainly they bear the influence of many different sources of information. While it is written as a narrative, the purpose of these thoughts are to set a foundation which will explain the fundamental purposes behind the proposed shift in focus from Industrial Arts to Technology Education.

Paul Cuetara, Summer 1988

Why Technology Education? Why Change?

Facilitating change in education must be preceded by establishing agreement as to what that change will be. The term Technology Education brings to mind different concepts to professional educators. One area of agreement exists among knowledgeable professionals, Technology Education is NOT Computer Education. While learning to use computers often becomes an important component of well-developed Technology Education programs, that is far from the program's primary goal. The primary goal is learning to use available resources to solve problems.

While identifying what Technology Education is we must agree on those distinguishing characteristics which make Technology Education a unique concept in education. Technology Education has been called applying technology to solve problems and perhaps in that we have that which makes Technology Education unique, the focus on solving problems. Providing students opportunities to work together to develop viable solutions to real problems is an important goal of all education and Technology Education may present a most unique curriculum to achieve this goal. At the same time students will be able to develop skills which will help them reflect on the quality of their decisions, while assisting them in developing an understanding of the impact of these decisions on their world.

Central to implementing Technology Education is understanding the Technological Loop Model of ***INPUT-> PROCESS-> OUTPUT-> FEEDBACK->***. This loop model is not intended strictly as evaluative of the final effort, but of each step within that process of Technology Education activities. Only by providing opportunities for students to develop solutions to problems within the process of developing a complete solution, will students be able to master those problem solving skills which will make technology work for them. This is the theme within which Technology Education can work in the school curriculum. It is valuable to have a program in the school in which a primary goal is for students to learn to recognize that for every problem there are a variety of alternative solutions which may be successfully implemented. At the same time providing the learners with practice using available technology to implement these solutions.

What is needed is not a new way to do the same thing that has been occurring in Industrial Arts. What is needed is to develop a new approach to use the same tools, facilities and staff. Key to this approach is to provide appropriate learning experiences to achieve the goal of a hands-on career-based program. Learning how to use the resources that are available as part of developing a solution to a need or want has become important to the students who will be living in the year 2000. As people learned to control fire for cooking and warmth, they must now learn to make appropriate decisions using available tools to satisfy their desires and needs.

Additionally, any effort to institute a change cannot overlook that work which has been done in other arenas. To "reinvent the wheel" not only is counter-productive, it also may serve to deny that the work has been done. It is important to recognize that others are working to develop solutions to the same problem. In this case the problem is how to shift our program emphasis to one dealing with issues of the year 2000.

In New Hampshire the effort to implement this new curriculum focus was initiated with the development and adoption in 1986 of a State Curriculum Guide on Technology Education (Industrial Arts). This guide reflected the current state of thought in Technology Education (Industrial Arts). However, how do we convince teachers, administrators and communities to initiate this change? Further, time in the school day is too valuable to have it used in content which may be fun, but is non-essential to the overall learning needs of the students. This is a fact many students seem to recognize more clearly than the professionals in our schools. In a sense then making, the transition to Technology Education becomes an issue of Technology.

Technology Education programs have effectively replaced traditional Industrial Arts in many parts of the country as a viable new component in the school curriculum. This component can become the focus of the school and "drive the curriculum" not simply be a part of it. Additionally, Technology Education interfaces effectively with the needs of both the pre-vocational learner and the academic learner in the school. In each case students are provided opportunities which challenge their individual talents in ways different than we have in the past.

Providing opportunities for students to be exposed to a variety of different careers has been stated as a primary goal of Industrial Arts, yet easily we can see that spending nine weeks on one unit is far beyond exploration and worse, it may be boring to the students. Whatever program we provide must change to one which is more clearly identified with a variety of activities, not limited to a few options. Professionals both within and outside of education have commented specifically to this point, an inordinate proportion of time is consumed on too limited a number of topics. It is important, these people add, that we have an opportunity in the school for young people to develop a better understanding of the array of technology which surrounds their world.

The transition to Technology Education will require that professionals recognize what in their approach, thinking, resources and facilities needs to be reorganized. This change in focus does not call for a total abolishment of what has been done, but a reorientation and focus to a more integrated approach to learning, both within the content area and within the school. Programs will change from units in Drafting, Woodworking and Small Engines to general studies dealing with Communications, Materials Processes, and Power, Energy and Transportation.

Traditional program content served an important role in the school for many years. However, now a need to help students develop more effective problem-solving skills has become a priority in education. Additionally, the tools used, and the way in which they are used have changed significantly, not only in the last 100 years, but even more dramatically in the last 20 years. Meanwhile much of the content of Industrial Arts programs has not changed. Technology Education programs can help students recognize that there are different ways to use new tools to develop solutions to problems which are viable and correct. A program which helps students understand how to find out how to more effectively use technology can become an important component of the education system. At the same time the implementation must be done without taking away from the time which must be reserved for English, science and math courses.

Initially, educators have to accept the fact that change can be positive and productive. Central to this transition process will be an understanding that change has occurred and we are only implementing this change within our courses of study. What we have been doing is not to be seen as inadequate, but rather inappropriate for the needs of the learners in our classes today. It will not be enough to provide a few computers, and say we are teaching the students to use them. We have to come back to the central issue of recognizing the uniqueness of a program focused on teaching how to develop solutions to problems, evaluate those solutions in relation to their impact, and finally implement the solution as important to those youngsters in our classes. In essence, understanding these skills may be a fundamental learning for those residents of the world 2000 as they come to terms with their society and their future. Reluctant traditionalists are resisting change with various arguments. Many of these people may find themselves without a teaching station unless they change. Certainly, now it is their choice!

What Is Unique About Technology Education?

Ron Jones of Bowling Green State University said that Technology Education involves a systems approach to learning about the problem-solving loop model. He describes this model to include input = resources; process = industrial processes; output = industrial applications; feedback = technological impact: all key distinctions unique to Technology Education. Further he believes that Technology Education is putting science to work for us in a systems approach, it is the study of technology systems but includes key issues of "questions of political and ethical values and help learners become technologically literate. Studying technology through Technology Education by using a technological systems model is easy, logical, and simple to organize. Presenting this model to students in class will provide them with a road map so that they can see where they are supposed to go and that you are going as a part of the class. Technology Education reaches all students, not just a limited few. The real world of work deals with all people and their range of abilities. We should too. Therefore, it is an opportunity for Industrial Arts programs now focusing on limited numbers to move into a general education program that will focus on all students and provide opportunities for all students to be involved."

Don Lauda suggests that the "focus must be on the means to help children understand their technological environment to be responsible adults who can make rational decisions about their technological power. There are three major adaptive systems that man has used to survive: 1-technological; 2-ideological; 3-sociological. Technology is the study of the technical means that have always been a primary determinant of cultural change: Three sub-systems are: communication; construction/materials; and transportation. Each using inputs, processes, and outputs with feedback as a unique characteristic of technology education."

Lauda adds saying, "that an interface should exist between the two areas of Math and Science and Technology Education. One provides the ability to understand; the other seeks uses of knowledge with these two working together in a symbionic relationship to explain natural laws and help man adapt to his environment."

The relationship of science and technology can be shown as:

Science	Technology
investigates concepts	interfaces with the natural order
investigates reality	creates reality according to design
universal truths	practical application of truths
enlarges knowledge	means to develop effectiveness
provides ability to under-	develops processes that seek the stand
natural/physical world	uses of new knowledge.

Don Maley adds to this by saying, "that Technology Education involves the application of knowledge of math and science within five approaches: innovative, systems, process, construction, research and experimentation. There therefore must exist certain implications for a transition interface including: inservice training, pre-service education and an interdisciplinary approach, developing the background for new concepts to be accepted within the membership of the profession."

The Pennsylvania Industrial Arts Association, now the Technology Education Association of Pennsylvania, took an initial step making this transition to Technology by redefining and refocusing existing courses titles with an emphasis on change from Industrial Arts to Technology Education. In this guide they decided that the K-6 program should be a part of the total elementary curriculum to reinforce learning and develop a better understanding of content. They helped infuse this through inservice training and use of team approach to studies.

Using the twelve goals of a quality education program, a model has been developed showing how Technology Education (Industrial Arts) can impact on students' overall personal skill development: Work, Health, Family Living, Environment, Self-Esteem, Science and Technology, Understanding Others, Math, Citizenship, Communication skills, and Analytical Thinking. Implementing this model in the Middle School program courses should be exploratory, providing for understanding of industry/technology and career awareness within three clusters of Communications, Materials Processes and Power, Energy and Transportation. In the High School program these courses are designed to include approval for graduation credit under school arts and humanities requirements. All programs are to also include AIASA and Safety as components of instruction.

Another writer, Dennis Swyt explains by saying, "Technology: All of the machines, devices, materials and processes as tools by which we manipulate, change and control the material world to satisfy our hierarchy of human needs. Technology is different from science in that it deals not with the phenomenon of nature, but with the phenomenon of man-made devices. Technology is like science in that it shares a knowledge structure which combines the theoretical with the experimental in an intellectually satisfying, demonstrably verifiable whole. Technology curriculum should provide the field with: intellectual vigor and knowledge specific to its domain, and practically add a hands on experimental basis specific to this domain"

Vincent Walencik adds, "Technology education is both a new curriculum and a strategy for teaching....Technology, according to this contemporary definition, is a process that brings together human and material resources to solve problems. To study technology, therefore, is to analyze available resources, how these resources can be interrelated, and what can be expected as a result."

Dr. Ronald Todd reported that the Barnes Study defines: "Technology education as: The study of the nature of adaptive systems to include their basic elements (tools, materials, processes, energy, information, and humans); the growth of those systems; the use of knowledge and technical means in solving practical problems; and the impacts of these elements, systems and activities on individuals, society and culture."

The New Hampshire Standards for Technology Education and Industrial Arts of 1986 suggested a need in the school for "a program which will provide students with learning opportunities that are uniquely designed to assist youth in understanding the era in which they will live and work". This guide recommends that content in the areas of: Visual Communications Technology; Materials Processes Technology; and Energy, Power and Transportation Technology should be provided. The goal of this guide is to help students develop an understanding of those aspects which are unique to industry and technology and to also assist individuals in making career choices.

Technology Education provides students their first opportunity to develop basic skills that they will need in the world of work; program goals must be exploratory, developing skills and values that will serve as the basis for making meaningful choices in a sophisticated technological society. Technology Education will continue to teach students the materials and processes of industry, but add the thinking skills needed to help them understand how to use these technologies. More than one teacher in New Hampshire has indicated that Technology Education should be an integrated study within the curriculum but, that more information on how to integrate the concept in courses that are existing is a priority.

From "*The New Basic*", a video program produced by Delmar Publishers developed for the International Technology Education Association, A Technology Education program must be:

- ***Based on technological systems***
- ***knowledge based***
- ***deal with social and cultural impact of technology***
- ***activity based***
- ***provide interdisciplinary learnings***

Perhaps we can reach agreement that the programs of the 1980's and 1990's must focus their impact on the needs of the learner of the world of 2000. One of the basic concepts of Technology Education is that to deal with the impact of a technological decision on our lives. Continuing to foster technologies which are considered inappropriate for the year 2000 may not serve a useful purpose for today's learner.

Technology Educators must become sensitive to providing students those learnings which are essential to their needs, not just those which are fun. At the same time as change is instituted we need to respect those professionals in the system and maximize the use of their facilities. Essentially the basis of Technology Education must be technology, not applied science.

Support for this movement is evidenced on a number of fronts. Dr. Richard Foley of Keene State College said, "We must identify the ways in which technology will have an impact on us and then make students become aware of it. There is a need for an integrated curriculum which will serve the needs of students...you have to train people to make a change."

Following this thought Joseph Keinberger, Assistant Personnel Director of Stone and Webster Engineers, believes that, "the world is much more complex and somehow we need to help youngsters understand how complex it is and not teach them skills which are out of date...traditional learning is historically interesting, but not functionally useful to those who will be residents of the world of 2000." Frank Kucharski, Project Engineer of the same company added, "it is important to teach youngsters how to figure the best way to take a working environment, using all resources, plan and develop a product."

New Hampshire Principals Gordon Quimby of, North Hampton Elementary School, and John Williams of, Newmarket Jr-Sr High School share in the belief that learning about technology is important in the school. Quimby said, "you do not have to understand how the technology works, only that it works in certain ways. There is a need to provide a meaningful real world experience for youngsters in school to try out learned math and science skills." Williams supported this statement by saying, "students clearly need to learn to make appropriate choices using technology to solve problems. It would make sense that the core curriculum should be focused in learning about technology."

Concerns and Issues Raised About Implementing Technology Education

In response to the many concerns raised about the implementation of Technology Education the following list of common questions and answers was developed.

1. What is the best way to phase from Industrial Arts to Technology Education?

By taking one step at a time. Assess the current Industrial Arts program and determine which components need to be slightly modified only and those which will require major reworking. Begin by changing units within courses which will then lead to changing the entire course to reflect the implementation of Technology Education. It is important to continue to offer electives in other areas for those students in the upper grades who find value in the more traditional craft-based courses as they advance in their learning experience.

2. Aren't we changing the cover of the same book?

Clearly the answer here is no. We are not presenting the same content, we are presenting a modified content in a different way. This will be accomplished by taking that which has been successful and modifying it into a technology concept.

3. Don't kids need to learn drafting, woodworking, etc.?

Certainly, but not to the extent and emphasis which has been made in the past. Industrial Arts purported to be career exploratory, and then offered students limited options spending long periods of time teaching skills which are no longer components of the nature of work as they will find it upon graduation. It is more functional to provide students with a greater variety of experiences specifically related to the world in which they will be living when they leave school.

4. How can we upgrade our equipment?

Always an issue of Technology is to make the most effective utilization of the available resources. Since the concept is more focused on teaching problem solving, it is not necessary to have everything at the beginning. A good equipment purchase plan over the two or three years required to implement the content should be satisfactory. Also, there is money through Vocational Education funds which can be used to achieve an upgrade.

5. Technology Education will be so expensive the budget committee won't buy it?

Technology Education programs, properly planned, should not cost any more than traditional Industrial Arts programs, however a rethinking of the budget process must take place to provide the kinds of activities students need. Also, long range plans must be developed to allow districts to phase in the purchases of supplies and equipment to implement a Technology Education program. At the very least some portion of budgets will need to be open ended providing resources for student-directed efforts.

6. What inservice is there right now to help change?

The New Hampshire Industrial Education Association provides workshops and summer week-long institutes in different areas. As more schools initiate the change, cooperative efforts in the area of teacher training will become more available as well. Efforts to establish regional Technology Institutes and/or networks are also being made to provide regionalized support for Technology Educators attempting to upgrade their programs.

7. How can we teach technology, we don't have computers?

The fundamental concept of Technology Education is developing appropriate solutions to issues that arise. Certainly those tools available are to be used, but also an effort needs to be made to integrate the instruction within the school content to maximize those available resources. As students show that they will use computers the need will be documented for purchases.

8. We can't just throw out everything we have built up?

Don't! The implementation of Technology Education does not require, nor imply, starting over from the beginning. Initially the implementation will consist of reordering our priorities, our thinking and our facilities. By using what we have that has been successful and then modifying the concept to one based on learning about solving problems, we will have made a major forward stride toward Technology Education.

9. How will Technology Education help students' skill development?

Technology Education will aid students' skill development by reinforcing those learnings in the other areas of the curriculum. Technology Education will provide opportunities for applying learnings in meaningful situations.

10. If we call courses Technology Education, we may not get kids in Industrial Arts classes?

Perhaps the students are telling us something we already should understand about the courses that are offered as electives at the present time.

11. What about students who need certain courses for college entrance requirements?

Students will have to determine those courses which will assist them in achieving success after high school. The concept of providing waiver of credit for Technology Education can be dealt with by open administration which will label student records in a manner appropriate for their needs.

12. How will lower level students fit into Technology Education classes?

Technology Education programs are for students of all abilities. One key issue is to understand that the focus of problem solving, versus project modeling, will provide every student better opportunities to develop as individuals. Further, students of the lower ability levels will be working in a cooperative environment, rather than one in which they are totally dependent on their individual skills for success.

13. How do you insure the quality of the students in the course?

As students recognize that the content is valuable to their learning and that the program offers them more than "craft skills", they will find it attractive to them.

14. Why change when we can't fill our courses now?

That may in itself be the motivating factor for change. Students have always recognized those courses which were of value to them in the school curriculum. Similarly, they know which courses will not satisfy their needs.

15. How do we sell the program to traditionalists?

It is important to recognize that traditional programs no longer offer students learnings which are relevant to their needs as citizens in the world of 2000. Certainly the enrollment trends in IA programs are one indication of this factor. It is very important to understand that Technology Education is not only an area of content, but more importantly, it is a method of teaching.

A GUIDE FOR CHANGE ---
MAKING THE TRANSITION
FROM
INDUSTRIAL ARTS
TO TECHNOLOGY EDUCATION

SECTION C
IMPLEMENTING
TECHNOLOGY EDUCATION
PROGRAMS

WHAT IS THE METHOD OF TEACHING USED IN TECHNOLOGY EDUCATION?

If technology education is to impart more than simple facts and if the understanding of the process of technology is an important objective of the program, then technology education should place the student in a position to participate as a decision maker in the technology process. Technology education allows the students to play a variety of roles such as designer, engineer, fabricator, controller, evaluator, and consumer. As confidence and skill develop within students through designed experiences, less and less direction is given to students and the teacher assumes a "facilitator" role. In this manner students must take on more and more responsibility to think for themselves. Through application of the problem solving model, teachers will require students to determine answers themselves rather that relying on teachers to give solutions to problems.

The ***"Design Loop"*** provides an educational model which emphasizes the continuing and holistic nature of the technological design process, as follows:

1. ***Analysis and Investigation of a Real-World Situation*** - The process should logically start with a critical examination of a real-world situation to determine the presence and nature of a problem.

2. ***Framing of a Design Brief*** - A statement describing what a solution to the problem should do and what constraints are being imposed is necessary to keep the process on track.

3. ***Information Gathering*** - Before attempting to develop solutions, the designer (student) must become familiar with the influencing factors associated with the problem. What attempts have others made to solve this problem? What are the sizes, stresses, loads, power requirements, appearance and ergonomic factors involved? These are some of the sub-problems which must be addressed if viable solutions are to be found.

4. ***Generation of Alternative Solutions*** - If this were a mathematical or scientific problem, only one right answer would probably be correct. But in a technological problem, there are no right or wrong answers, only good or bad solutions. To arrive at a good solution the designer will need to look at many alternatives. Students will probably find this the most challenging step in the process, calling for originality and flexibility.

5. ***Choosing the Solution*** - From the alternative solutions developed, the student must choose one which best satisfies the demands of the situation and the design brief. He/she should be able to defend the choice with reference to each requirement of the situation and the brief.

6. Developmental Work - (drawings, evolutionary models, simulations, etc.) This step may manifest itself in the form of a device, computer simulation, a series of graphic sketches or a two-dimensional model made of flexible materials. The design brief and initial problem/need will specify the final outcome of this step. Often the student will make various models before making an operational device. Appearance is not very important at this stage. Appearance takes on importance after testing and evaluation have confirmed that the solution chosen meets the specified requirements. Developmental work also includes technical planning of procedures and resource management.

7. Prototyping - This is the actual construction/realization step of the process. Appearance is more important here, but only so far as the need to "sell" the idea or product. After the device is tested and revised, the prototype may be "finished" for demonstration. The device or product should be operational and quality work should be in evidence.

8. Testing and Evaluation - The solution should always be evaluated against the requirements established in the design brief, and against the original problem statement. Testing the solution to see if it handles the load, operates correctly, meets appearance requirements, is reliable and solves the problem, is an important part of the design process. Evaluating the result should address the need for improvements, changes, etc.

9. Redesign/Reimplementation - If there is time, the evaluated and tested solution may be reworked and retested. This is especially important if the product is to be produced in any quantity or if it is to be put into actual use to solve a real-life problem. At this stage, the appearance of the product takes on more importance.

Even if the product isn't taken to real-world application consideration should be given to how the solution would (or does) "change the world". Such consideration "closes the loop", reinforcing the nature of design as suggested by the model, and provides a forum for considering the idea of "impacts".

As technological advances occur in the world, a common element is needed by citizens: the ability to solve problems arising from change. Technology education teaches students the process of problem solving while engaging them in activities associated with testing/designing/making, etc.

SAMPLE COURSE DESCRIPTIONS FOR TECHNOLOGY EDUCATION

TECHNOLOGY EDUCATION I

Technology Education I is an exploratory course in which students will investigate the nature of technology as it applies to their daily lives. Through a series of student directed activities, participants will use the problem-solving methodology to study problems in the areas of Communications Technology; Power, Energy and Transportation Technology; Construction Technology; and Manufacturing Technology. Using problem-solving technique, students will develop skill interacting with the technology loop model of *Input-> Process-> Output-> Feedback->*.

Students will participate in a variety of individual and small group laboratory activities related to the study of each of the different areas of technology. Students will also participate in leadership development activities by involvement with a Technology student youth organization as an integral component of the class instruction.

Students will be expected to follow all safety guidelines appropriate for each of the activities in which they will be involved. Safety glasses are required and there may be a charge for some materials which are consumed by the students.

TECHNOLOGY EDUCATION II

Technology Education II is a second level Technology Education Course for students to further their exploration of the areas of Communication Technology; Power, Energy and Transportation Technology; Construction Technology; and Manufacturing Technology. Working individually, in small groups, and as an entire class unit, students will continue to use the problem-solving method to develop solutions to issues of each of the various technology areas. This will be accomplished by students working through design briefs which will provide the basic parameters for solutions which will be student developed.

Students will continue leadership skill development by continued participation in student organization activities as a part of the instruction.

Students will be expected to follow all safety guidelines appropriate for each of the activities in which they will be involved. Safety glasses are required and there may be a charge for some materials consumed by the students.

Technology Education

For purposes of developing class unit plans within a school curriculum the following outline is proposed. The three clusters of Communication; Power-Energy-Transportation; and Materials Processes can be offered in four nine week units. Topics would be offered in Communications; Power-Energy-Transportation; Construction and Manufacturing; Technologies. This model is recommended for two reasons. First, Communications and P-E-T are involved within the study of Materials Processes; secondly four units seem to interface more efficiently within traditional school calendars/sessions.

Introduction to Technology I & II Topics to Cover

Suggested Topics in Technology Education I :

Communication Technology

Safety
Sketching views
Principles of drafting
Geometric Constructions
Computer Assisted Drafting
Photography
Desk Top Publishing
Screen Process Printing
Audio Communications
Video Communications

Power-Energy-Transportation Technology

Safety
Energy sources
Fundamentals of Electricity
Simple Machines
Power generation systems
Alternative Energy
Small Gasoline Engines
Controls

Construction Technology

Safety
Model Construction Systems
Model Bridge Building
Tower Construction
Alternative Material structures

Manufacturing Technology

Safety
Product development
Product Selection & Design
Jig & Fixture development
Preparing to Produce
Producing a product

Suggested Topics in Technology Education II :

Level II Course Units would either cover topics not dealt with in Level I programs or provide design briefs which would challenge students to develop solutions to problems using the variety of technologies which are available in their laboratories. In either case the purpose of the Level II program would be to provide integration and further development of the Level I Technology Education activities.

Suggested Technology Education I Unit Plan

All times are suggested and should be modified based on local needs such as testing, holidays, etc.

Communications Technology I

Time	Topic to be covered
1 week	Safety & Introduction to Communication systems
1 week	Sketching
2 weeks	Geometric Constructions
2 weeks	Pictorial and Multiview Representation
2 weeks	Introduction to CAD Systems with Apple Computer
1 week	Introduction to Photography

Power-Energy-Transportation Technology I

Time	Topic to be covered
1 week	Safety & Introduction to P-E-T Systems
3 weeks	Basic Theory/Practice of Electricity
2 weeks	Alternative Energy Systems
3 weeks	Basic machines/power systems

Construction Technology I

Time	Topic to be covered
1 week	Safety & Introduction to Construction systems
2 weeks	Design & Construction (drawing, planning, budget)
3 weeks	Bridge Building Activity
2 weeks	Straw Tower construction
1 week	Alternative Materials Design/Construction

Manufacturing Technology I

Time	Topic to be covered
1 week	Safety & Introduction to Manufacturing systems
1 week	Designing a production system
3 weeks	Preparing to manufacture a product
2 weeks	Production of Manufactured product
2 weeks	Marketing, Sales, Distribution and Service of a manufactured product

Suggested Technology Education II Unit Plan

All times are suggested and should be modified based on local needs such as testing, holidays, etc.

Communications Technology II

Time	Topic to cover
1 week	Review of Safety and Communication Tech. Systems
2 weeks	Students design and print two products using process printing media.
3 weeks	Students participate in the development of Technology Newsletter promoting their program activities and relevant school events
3 weeks	Students to select one area of Communication Technology Systems to prepare class presentation of this system via product, model, report or other effort approved by the instructor

Power-Energy-Transportation Technology II

Time	Topic to cover
1 week	Review of Safety and P-E-T Technology Systems
3 weeks	Introduction to control systems (using LEGO or similar product with control/interface)
2 weeks	Students design and construct electric-powered vehicle using available materials for in-class competition for power and/or speed
4 weeks	Students to design and develop demonstration of power-energy-transportation system (model, working demonstration, display, etc., etc.)

Construction Technology II

Time	Topic to cover
1 week	Review of Safety and Construction Tech. Systems
4 weeks	Students to design and construct scale model of building, residential or commercial, of their choice demonstrating new and emerging technologies.
4 weeks	Students to design and construct model showing one major system of construction (electrical, waste disposal, etc., etc.), showing a solution to the development of this system in construction.

Manufacturing Technology II

Time	Topic to cover
1 week	Review of Safety and Manufacturing Technology
8 weeks	Class develop company to establish Manufacturing Enterprise organization to conduct appropriate research and development necessary to select, design and produce a product either unit production, one per class member, or for sale depending on existing school policies.

Structuring Technology Education Programs

Abstracted from: Industry and Technology Education
Guide for Contemporary Industrial Arts/Technology Education Curriculum

This Industry and Technology Education Project participants accepted the *Jackson's Mill Project* philosophy as the basis for developing content structures and taxonomies for the four industrial-technological systems (communication, construction, manufacturing, and transportation). Using this work as a basis, program structures were developed using the following assumptions:

1. All students need a basic foundation of knowledge and experience about industry, technology, and their societal context.

2. The foundation must include broad introductory experiences which present the interface among research and development, industrial/technological systems, service, use, and personal-corporate management interaction.

3. The program must include specific experiences in each of the four industrial/ technological systems communication, construction, manufacturing, transportation.

4. The experiences in the industrial/technological systems should include both the productive and the management activities of the system.

5. The industrial/technological systems are best understood if examples are provided of the design of the product or system and the productive activity of the system.

6. The enrollment of the industrial arts program will determine the number and variety of courses that can be offered.

7. Synthesis courses in research and development and in enterprise should be included in the program of any school.

8. Prerequisites should be minimized to encourage flexibility in student enrollment.

9. All courses should use practical laboratory activities to enhance fundamental conceptual development.

10. Experiences about the industrial/technological systems should be integrated into the elementary school curriculum.

Common Elements of Technology Education Programs

Using these assumptions as guidelines, a series of three model program structures are developed to accommodate technology education (industrial arts) programs of different sizes. The following charts present these program structures.

Each program structure has five common elements:

1. **Exploring Industry and Technology Units**
   These are a series of locally developed units which integrate concepts about industry and technology into the existing elementary school curriculum.

2. **Introduction to Industrial and Technological Systems**
   The first course offering in industry and technology. It provides a comprehensive introduction to the subject matter including all four technical systems -- Communication, Construction, Manufacturing and Transportation.

3. **Communication Systems; Construction Systems; Manufacturing Systems; Transportation Systems**
   Four courses which provide separate introductions to each of the four industrial and technological systems.

4. **Industrial Enterprise**
   A synthesis course which emphasizes the managed system used to manufacture a product, construct a structure, communicate a message, transport people or goods.

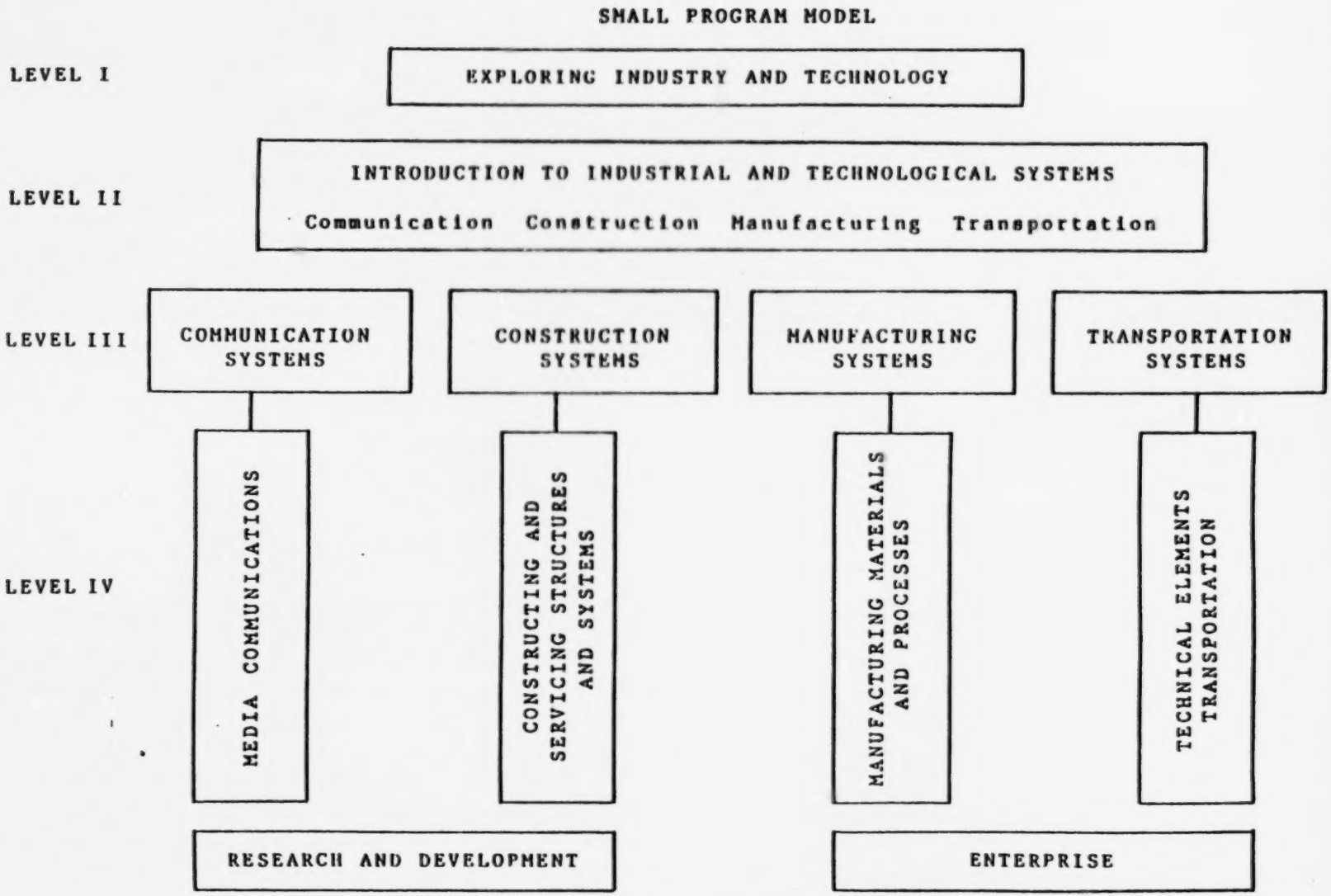
5. **Research and Development**
   A synthesis course designed for individuals or groups to pursue new knowledge or project solutions for industrial and/or technological problems.

Note: These common elements would constitute an adequate technology education (industrial arts) program for a school with limited enrollment. Schools with large enrollments can add more specialized courses in each of the industrial/technological systems. These courses are shown as Level IV in the charts that follow this discussion. The charts are listed for (1) small, (2) medium, and (3) large programs. For this project these three sizes were defined as follows:

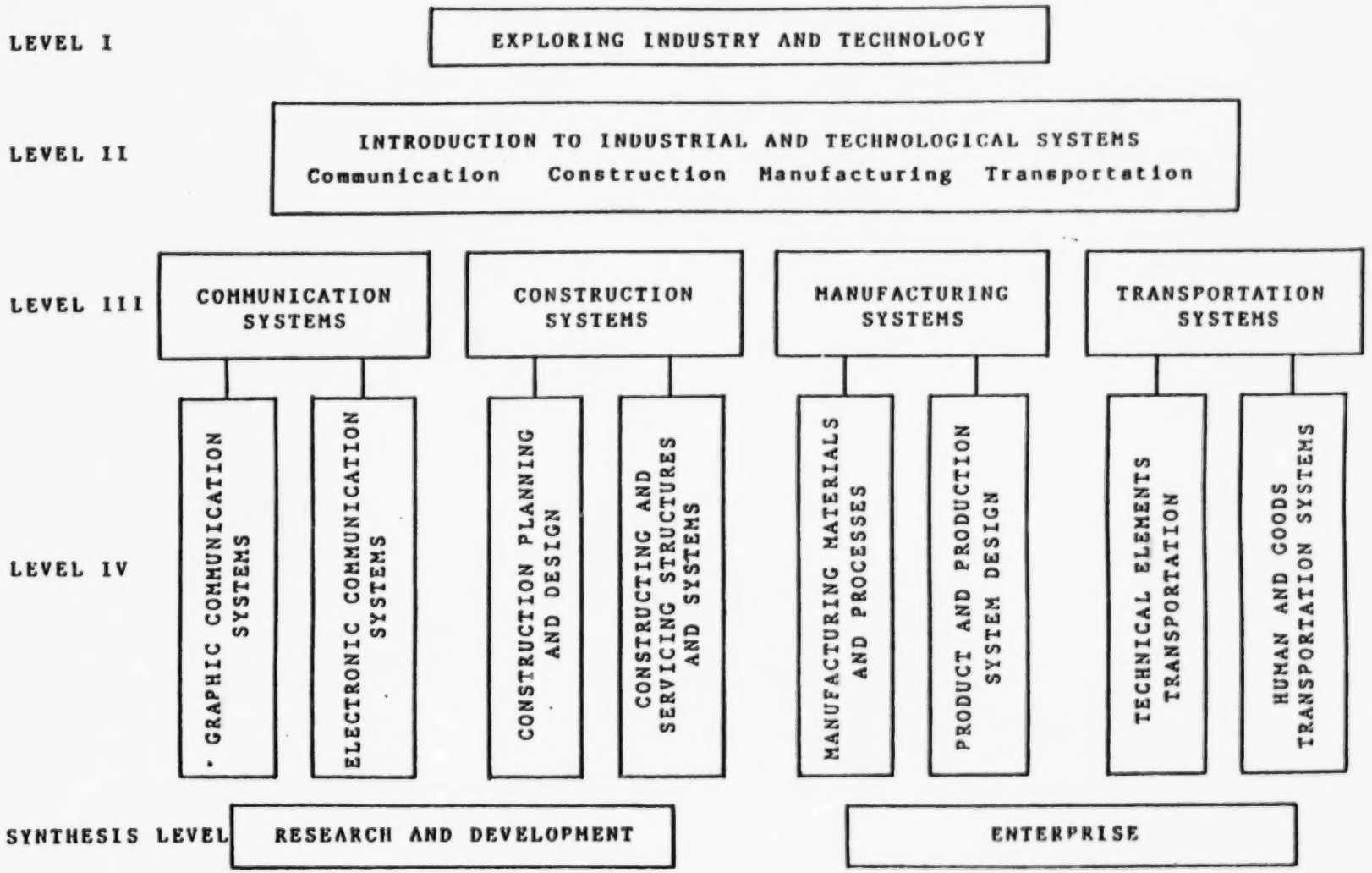
Small Program - Typically, this program would have one or two technology educaton (industrial arts) teacher(s) and a technology education (industrial arts) enrollment of under 160 students at any one time.

Medium Program - Typically, this size program would have two or three technology education (industrial arts) teachers and a technology education (industrial arts) enrollment of between 160 and 300 students at any one time.

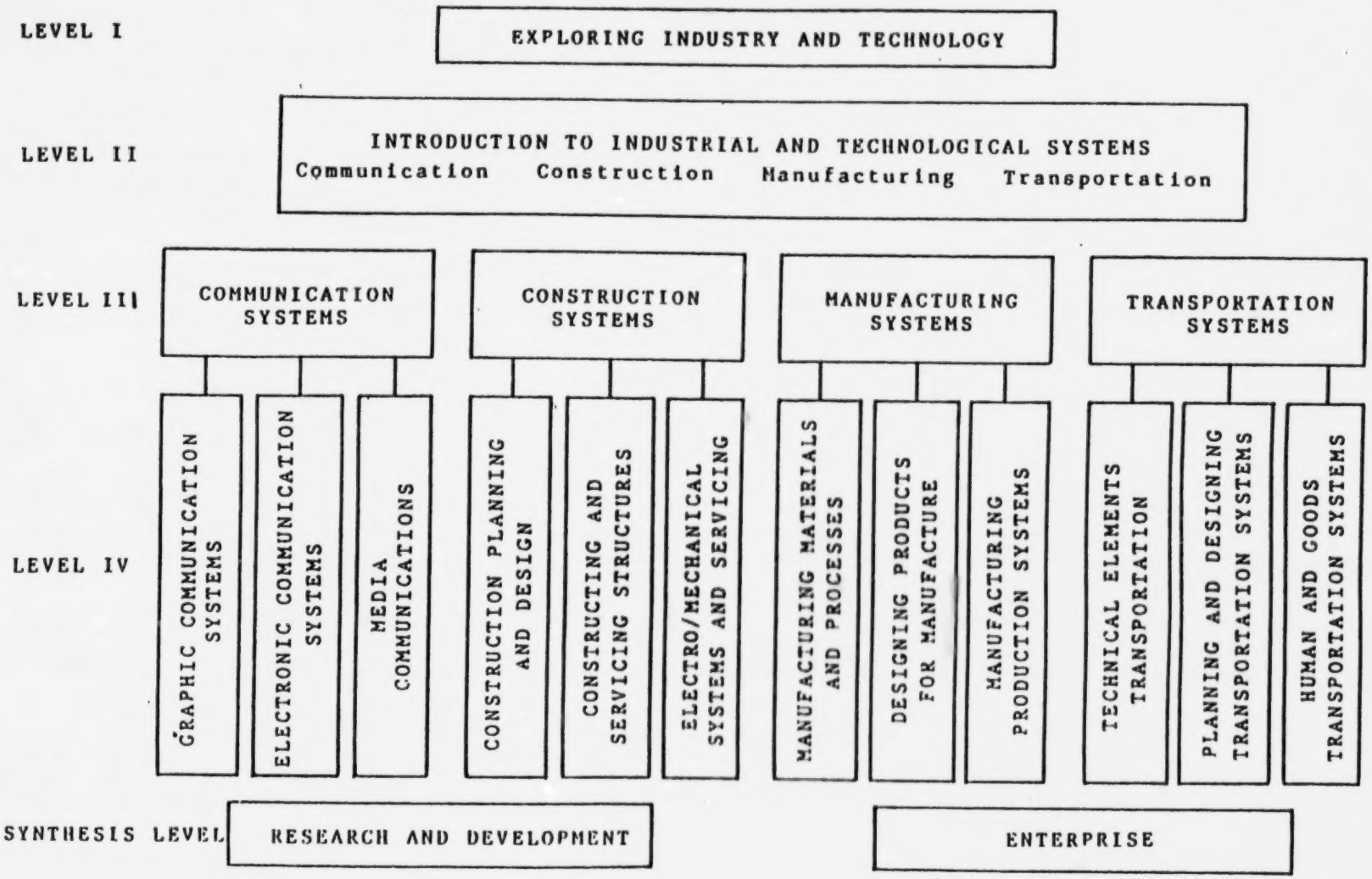
Large Program - Typically, large programs would have at least four technology education (industrial arts) teachers and over 320 students enrolled at any one time.


SMALL PROGRAM MODEL
LEVEL I
EXPLORING INDUSTRY AND TECHNOLOGY
LEVEL II
INTRODUCTION TO INDUSTRIAL AND TECHNOLOGICAL SYSTEMS
Communication Construction Manufacturing Transportation
LEVEL III
COMMUNICATION SYSTEMS
CONSTRUCTION SYSTEMS
MANUFACTURING SYSTEMS
TRANSPORTATION SYSTEMS
LEVEL IV
MEDIA COMMUNICATIONS
CONSTRUCTING AND SERVICING STRUCTURES AND SYSTEMS
MANUFACTURING MATERIALS AND PROCESSES
TECHNICAL ELEMENTS TRANSPORTATION
RESEARCH AND DEVELOPMENT
ENTERPRISE

MEDIUM PROGRAM MODEL



LARGE PROGRAM MODEL



Inservice Model Proposed to Assist in the Implementation of Technology Education - The Technology Education Institute

In order to implement any change on education that will be long lasting in nature and meaningful to the learner, training for the teachers who will be involved must be offered. It is proposed that one-week Technology Summer Institutes at different sites around the state be set up using a similar agenda to provide updating of teachers skills in Technology Education. Participants would include Technology Education (Industrial Arts) Teachers and Math and/or Science teachers from schools located geographically throughout the state of New Hampshire. The purpose of these Institutes would be to provide related inservice training and opportunity for curriculum improvement at each participant's school.

Each institute would be led by at least three professionals charged with the responsibility of the program. One person would be a facilitator, whose job it would be to handle the logistics of the institute administratively. Another person would be a technology teacher, or similar professional with specific expertise in one of the three cluster areas of Technology Education. The third staff member would be an individual competent in assisting teachers in assessing, updating and writing curriculum for each participant's local program.

Program sessions would begin Monday morning and continue during the five days and four evenings until Friday afternoon. Content would include experiences designed to provide teachers with specific expertise in one Technology Cluster. Time would also be provided for teachers to work on changes in their own school curriculum. Activities would be provided in a manner similar to the way in which teachers would present similar technological learning experiences to their students.

Schools interested in participating in this program would be invited to enter into a three-year contract with the project. Participants would receive a stipend, expenses, meals and materials for this program and for later use in their schools. Institute costs would be shared between the state and local district during the contract term with the local district portion increasing each year.

A GUIDE FOR CHANGE ---
MAKING THE TRANSITION
FROM
INDUSTRIAL ARTS
TO
TECHNOLOGY EDUCATION

SECTION D
TECHNOLOGY EDUCATION
PROGRAM GUIDE
AND APPROVAL STANDARDS

New Hampshire Technology Education

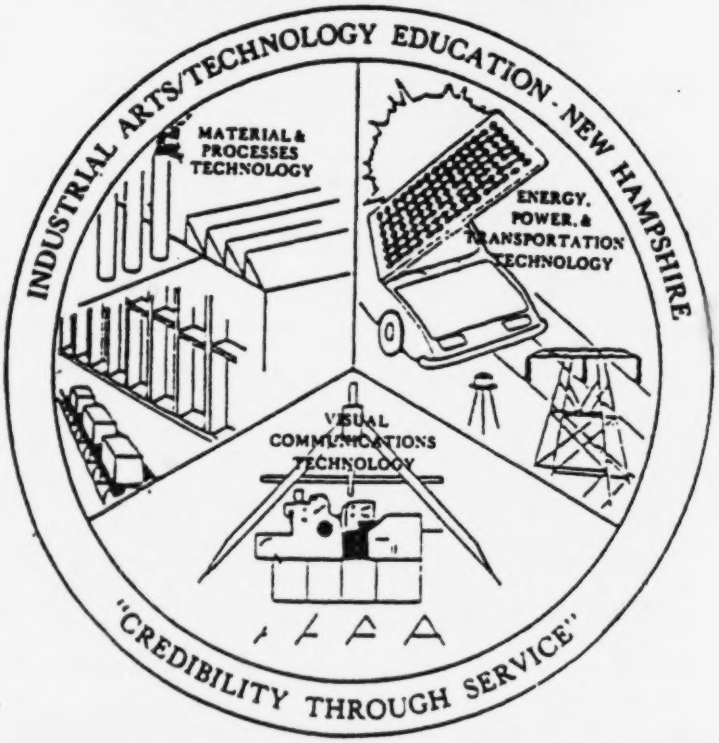
(Industrial Arts) Program Guide

As an integral component of the Transition to Technology in New Hampshire the Guide is included. Developed in 1986 the changing terminology issue has not been resolved. In this document the curriculum is identified as "Industrial Arts/Technology Education" as an interim label. Currently that has been changed to "Technology Education (Industrial Arts)". This is being done to provide for the inclusion of this program in all states where the local terminology may not be consistent with the state of the art terminology in Federal Vocational Education Legislation. Both the International Technology Education Association and the Industrial Arts Division of the American Vocational Association are supporting this transitional terminology.

It is suggested that the reader visually insert the current use terminology, "Technology Education (Industrial Arts)" whenever the earlier transitional terminology "industrial Arts/Technology Education" is used in this guide. This simply reflects the changes since its development in 1986 to the present.

NEW HAMPSHIRE
INDUSTRIAL ARTS
AND
TECHNOLOGY EDUCATION

PROGRAM GUIDE


INDUSTRIAL ARTS/TECHNOLOGY EDUCATION - NEW HAMPSHIRE
MATERIAL & PROCESSES TECHNOLOGY
ENERGY, POWER, & TRANSPORTATION TECHNOLOGY
VISUAL COMMUNICATIONS TECHNOLOGY
"CREDIBILITY THROUGH SERVICE"

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-1986-

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-INTRODUCTION-

This Guide is designed to provide direction for instructional programs in Industrial Arts/Technology Education throughout the state of New Hampshire. It should assist teachers, counselors, administrators, legislators, parents, industrialists, and interested citizens in a better understanding of the potential benefits of a comprehensive program of experiential activities in Industrial Arts/Technology Education.

Public school teachers, state consultants, and college professors of Industrial Arts/Technology Education cooperatively contributed to the development of this publication. All participants in the project are listed in the "Acknowledgements" section at the end of the brochure.

The effort was supported by vocational education funds for Industrial Arts/Technology Education program improvement.

Robert C. Andrews,
Project Coordinator
June 1986

-PHILOSOPHY-

Rapid technological change and advancement characterize the contemporary culture. Therefore, it is imperative that schools provide the learning opportunities that are uniquely designed to assist youth in understanding the era in which they live and work. Such is the professed role of Industrial Arts/Technology Education.

Industrial Arts/Technology Education provides opportunities for all students from junior high school through higher education to develop an understanding of the technical, occupational, recreational, organizational, managerial, social, historical, and cultural aspects of industry and technology.

Programs of instruction can be individually tailored to challenge the gifted, average, handicapped, and disabled student. Society offers success and satisfaction to people who can achieve academically and technically while employing a positive attitude towards work and others.

Industrial Arts/Technology Education seeks to develop a well-rounded individual who is prepared to succeed within the contemporary and evolving nature of work, leisure, home and civic life.

-DEFINITIONS OF INDUSTRIAL ARTS/TECHNOLOGY EDUCATION-

Industrial Arts/Technology Education is the study of industry and technology and their effects on society. It provides planned learning experiences which develop attitudes, knowledge, and skills related to Visual Communication, Energy-Power-Transportation, and Materials and Processes Technologies.

Industrial Arts/Technology Education includes instruction and activities in experimenting, designing, constructing, evaluating, and using tools, machines, materials, and processes. The knowledge and skills acquired through Industrial Arts/Technology Education assist students in making informed and meaningful occupational and educational choices.

-PROGRAM OBJECTIVES-

INDUSTRIAL ARTS/TECHNOLOGY EDUCATION seeks to:

* Develop an insight and understanding of industry and technology, their place in our culture, and the free enterprise system;

* Develop basic technical skills in the safe and proper use of technical instruments, tools, machines and processes;

* Discover and develop talents, aptitudes, and interests of the individual related to technical pursuits;

* Develop problem-solving and creative abilities involving materials, processes, and products of technology;

* Develop understanding of technical processes, the practical application of scientific principles, and the interrelationships between Industrial Arts/Technology Education course content and other subjects in the school curriculum;

* Develop an understanding of career opportunities and requirements, and assist individuals in making informed and meaningful occupational choices, in furthering their education, and/or obtaining and maintaining employment in technical fields; and

* Develop an understanding of mathematical and scientific concepts through the practical applications of mathematical calculations and the knowledge base of physical and natural sciences to solve technical problems.

-PROGRAM DESIGN EMPHASES-

Industrial Arts/Technology Education programs are integral parts of the comprehensive educational experiences considered fundamental for all youth. Public education should provide all students with an opportunity to develop technical knowledge and skills according to individual interests and abilities. The increasing complexity of our economy and the pace of technological change encountered in every phase of daily living make it essential that Industrial Arts/Technology Education be required of all middle-junior high school students, and available on an elective basis for high school students.

ELEMENTARY SCHOOL: "Appreciation of Industry & Technology"

Industrial Arts/Technology Education programs are virtually non-existent in New Hampshire elementary schools. While numerous constructive activities are planned and implemented by elementary teachers, Industrial Arts/Technology Education teachers are not directly involved in such endeavors. Should participation be requested, they often assist with the organization and implementation of experiential learning activities related to the particular unit under study and designed to develop an appreciation of the industrial and technological nature of society.

MIDDLE/JUNIOR HIGH SCHOOL: "Orientation to Industry & Technology"

A minimum of one semester per year (at least 54 class hours) is required of all students. Basic courses should include short units of high interest. This instruction will provide an orientation to industry and technology, while the interdisciplinary nature of the program with other school subjects is developed and emphasized. Additionally, activities should promote problem solving skills, the free enterprise economic system, the development of basic manipulative skills in measuring, drafting and planning, safe use of tools and small machines, project fabrication, and an orientation to work and careers in many industrial-technical areas.

SENIOR HIGH SCHOOL

(Grades 9 & 10): "Exploration of Industry & Technology"

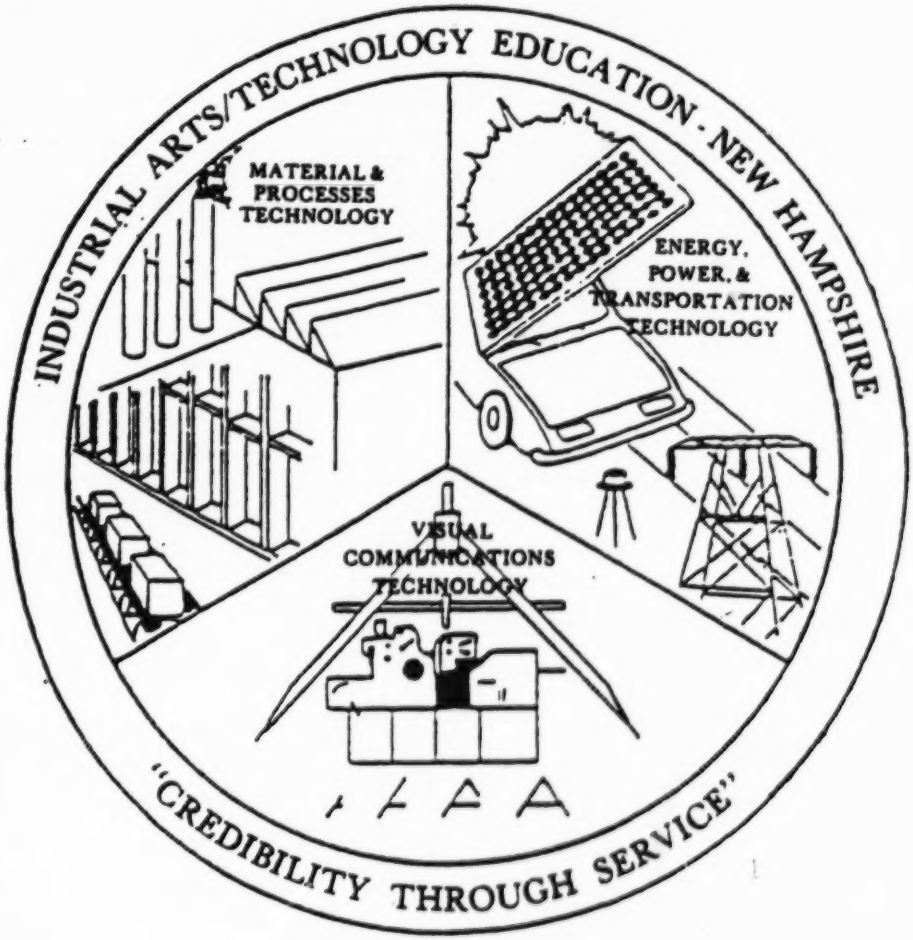
Programs during the first year or two in high school should emphasize the pre-technical exploration of industry and technology. This introduction should be as broadly based as possible, with each segment containing a minimum of 150 hours per year. Each area of exposure (Energy-Power-Transportation Technology, Materials and Processes Technology, and Visual Communication Technology) should provide an understanding of basic industrial and technological applications along with related pertinent career information.

(Grades 11 & 12): "Preparation for Industry & Technology"

Programs during the final two years should emphasize preparation for industry and technology, recreational interests, survival and consumer skills, and vocational competency. While many high schools offer Industrial Arts/Technology Education programs at this level, many students elect to participate in vocational trades and industries programs to develop a high level of proficiency in an occupational area. In some geographical areas of the state, Industrial Arts/Technology Education programs provide quasi-vocational opportunities for student development.

POST-SECONDARY SCHOOLS/COLLEGES: "Specialization in Industry & Technology"

This level is usually considered the responsibility of vocational trades and industries education. However, programs in Industrial Arts/Technology Education are available on an elective basis at Keene State College for the comprehensive general education of students. In addition, the College provides a teacher education program designed to prepare professionals in comprehensive, cluster, and subject area specialties of Industrial Arts/Technology Education, which lead to New Hampshire teacher certification.


INDUSTRIAL ARTS/TECHNOLOGY EDUCATION - NEW HAMPSHIRE
MATERIAL & PROCESSES TECHNOLOGY
ENERGY, POWER, & TRANSPORTATION TECHNOLOGY
VISUAL COMMUNICATIONS TECHNOLOGY
"CREDIBILITY THROUGH SERVICE"

-CURRICULUM DIVISIONS-

INTRODUCTION

Experiential activities are conducted at the middle/junior high school and senior high school levels that include varying levels of difficulty depending on the experience of the student. High activity/short-time duration involvements are particularly recommended for middle/junior high school students.

Delivery of an Industrial Arts/Technology Education program usually takes place through a series of courses included in the clusters of (1) Visual Communications Technology, (2) Materials and Processes Technology, and (3) Energy, Power and Transportation Technology. The following outlines include a series of ideas, activities, and topics that are suggested for inclusion in courses related to these cluster areas.

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-VISUAL COMMUNICATION TECHNOLOGY-

INTRODUCTION: Visual Communication Technology is the study of industrial-technical information, careers and their requirements through learning experiences and constructive activities involving safe and proper involvement in processes relating to message IDEATION, COMPOSITION, TRANSMISSION, RECEPTION, INTERPRETATION and REACTION.

GOALS:

- Orientation to visual communication technology, its associated industries, occupations, materials, processes, products, and services;
- Appreciation of the role, utilization, and contributions of visual communication technology to contemporary society;
- Participation in meaningful learning opportunities in visual communication technology under the guidance of a professional educator.

LEARNING AREAS: Visual Communication Technology Laboratory, including equipment, materials, furniture, and supplies for drafting and design, graphic arts, photography, and other associated activities.

OBJECTIVE #1: Students will utilize a well-organized environment (Visual Communications Technology Laboratory) for safe and productive experiential activities in accordance with the New Hampshire State Department of Education guidelines entitled, "SAFETY STANDARDS FOR RELATED PROGRAMS IN VOCTIONAL, TECHNICAL, INDUSTRIAL ARTS AND PRE-VOCATIONAL EDUCATION" and local building codes.

Suggested Learning Activities:

- Safety films
- Demonstrations
- Posters
- Permission slips
- Safety rules
- Guest speakers
- Quizes/Tests
- Safety policy
- Bulletin boards
- Class discussions
- Student safety committee

OBJECTIVE #2: Students will generate ideas and messages. They will discover and utilize the IDEATION process through creative thinking, problem solving and designing.

Suggested Learning Activities:

- Participate actively in brainstorming, think-tanks, and design teams.
- Develop "thumb-nail" sketches illustrating a series of preliminary pictorial design alternatives.
- Shape 3-D design alternatives in moldable materials.
- View films and slides of classic, traditional, and contemporary designs.

OBJECTIVE #3: Students will encode, construct and compose messages. They will participate in COMPOSITION activities through the formation, organization and development of informative messages.

Suggested Learning Activities:
- Generate hand and computer assisted drawings.
- Write, letter, keyboard, and/or edit message copy.
- Arrange art work and text material in the formation of total messages.
- Illustrate objects in pictorial, 3-D drawings for presentation.
- Compose verbal and graphic messages on a computer system.
- Discuss design alternatives to assist in aesthetic appreciation.
- Produce a format for the final message so that reproduction production is possible.
- Participate in tours of drafting and designing enterprises.
- Illustrate the size and shape descriptions on objects in 2-D multiview working drawings.

OBJECTIVE #4: Students will transmit information and messages. They will utilize TRANSMISSION means and methods through production and utilization of graphic, photographic, and electronic media.

Suggested Learning Activities:
- Produce ammonia prints of tracings.
- Chemically develop films, photographs and slides.
- Record audio and videotaped messages.
- Reproduce multiple copies of messages and/or illustrations on printing presses, duplicators, copiers, and/or computer print-out devices.
- Project slides.
- Show photographs.
- Participate in field trips to print shops, newspaper publishers, radio-TV stations, or copy centers.
- Publish a school newspaper.
- Evaluate the quality of drawings, printings, and photographs.

OBJECTIVE #5: Students will openly receive information and messages. They will participate in RECEPTION activities through observation and identification of messages.

Suggested Learning Activities:
- Read blueprints and written messages.
- Identify varieties of visual and verbal messages encountered in daily living.
- Read maps.

OBJECTIVE #6: Students will decode and interpret information and messages. They will refine INTERPRETATION skills through comprehension and evaluation of information.

Suggested Learning Activities:
- Recognize, interpret, and describe the designer's intentions presented in visual signs and symbols.
- Consider design alternatives through evaluation of possible products.
- Test product options through trial runs.
- Formulate decisions based on visual evidence.
- Interpret/understand logo designs and other semiotic messages.

OBJECTIVE #7: Students will follow directions and react to messages. They will show evidence of appropriate REACTION through the acceptance or denial of the intended information and messages.

Suggested Learning Activities:
- Write specifications from product designs.
- Construct models/objects described in plans.
- Follow directions as presented in messages or plans.
- Organize and sequence steps of operations.
- Compose an exhibit/display/presentation of student products.

OBJECTIVE #8: Students will be exposed to career opportunities in Visual Communication Technology and associated industries.

Suggested Learning Activities:
- Guest speakers
- Field Trips
- Films
- Handouts/pamphlets
- Class discussions
- Bulletin boards
- Posters

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-MATERIALS AND PROCESSES TECHNOLOGY-

INTRODUCTION: Materials & Processes Technology is the study of industrial-technical information, careers and their requirements, through learning experiences and activities involving the application and safe use of tools, machines, materials, and processes associated with woods, metals, plastics, etc. Additional study concentrates on their properties and utilization as they are fabricated into industrial consumer products.

GOAL: To provide the student with the opportunity to develop the interest, understanding, skills, and attitudes necessary for participation in our technological society.

LEARNING AREAS: Woodworking Technology, Metal Fabrication, Machine Shop, Manufacturing Enterprise, Materials Processing, Plastics Technology.

OBJECTIVE #1: Students will utilize a well-organized environment (Materials and Processes Technology Laboratory) for safe and productive experiential activities in accordance with the New Hampshire State Department of Education guidelines entitled, "SAFETY STANDARDS FOR RELATED PROGRAMS IN VOCATIONAL, TECHNICAL, INDUSTRIAL ARTS, AND PRE-VOCATIONAL EDUCATION" and local building codes.

Suggested Learning Activities:

- Safety films
- Demonstrations
- Permission slips
- Safety rules
- Guest speakers
- Quizes/tests
- Safety policy
- Posters
- Bulletin boards
- Class discussions
- Student safety committee

OBJECTIVE #2: Students will develop a plan in order to formulate a solution to an identified problem.

Suggested Learning Activities:

- Measurement
- Sketching
- Layout/planning
- Dimension interpretation
- CAD
- Methodology
- Problem solving
- Cost/bill of materials
- Student Self-Evaluation

OBJECTIVE #3: Students will experience the forming, separating, combining, fabricating, and finishing processes of wood, metal, and/or plastic.

Suggested Learning Activities:

- Cutting
- Bending
- Filing
- Assembling
- Sanding
- Abrading
- CNC
- Laser Technology
- Scraping
- Staining
- Coating
- Polishing
- Bonding
- Mechanical fastening
- Robotics
- CAM

OBJECTIVE #4: Students will be made aware of the classification and properties of materials.

Suggested Learning Areas:

- Softwoods/hardwoods/composition materials
- Ferrous/nonferrous metals
- thermo setting/thermo plastic

OBJECTIVE #5: Students will construct projects to demonstrate competency in the planning, selection, and processing of one or more materials.

Suggested Learning Activities:

- Teacher-directed, student-initiated group activities (mass production)
- Teacher-directed, custom production activities.

OBJECTIVE #6: Students will be encouraged to develop individual creativity, as well as the ability to work cooperatively with others in a joint venture.

Suggested Learning Activities:

- Public service projects
- Craft projects
- Establish an enterprise system

OBJECTIVE #7: Students will develop a measure of consumer awareness.

Suggested Learning Activities:

- Quality control
- Material selection
- Joinery
- Finish
- Cost
- Durability

OBJECTIVE #8: Students will be exposed to career opportunities in Materials and Processes Technology and associated industries.

Suggested Learning Activities:

- Guest speakers
- Field trips
- Films
- Posters
- Handouts/pamphlets
- Class discussions
- Bulletin Boards

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-ENERGY-POWER-TRANSPORTATION TECHNOLOGY-

INTRODUCTION: Energy-Power-Transportation Technology is the study of industrial technical information careers and their requirements through learning experiences and activities involving the sources, generation, storage, transmission and conversion of energy, the transmission and control of mechanical, electrical, pneumatic, and hydraulic power and the exploration of the various forms of transportation.

GOAL: Exploration of renewable and non-renewable energy sources and how power is converted and transmitted for practical uses.

LEARNING AREAS: Power and Energy, Small Engine Repair, Consumer Automechanics, Electricity, Electronics, Alternative Energy, and Energy Conservation, or Hydraulic/Pneumatics Laboratories.

OBJECTIVE #1: Students will utilize a well-organized environment (Energy-Power-Transportation Technology Laboratory) for safe and experiential activities in accordance with the New Hampshire State Department of Education guidelines entitled, "SAFETY STANDARDS FOR RELATED PROGRAMS IN VOCATIONAL, TECHNICAL, INDUSTRIAL ARTS AND PRE-VOCATIONAL EDUCATION" and local building codes.

Suggested Learning Activities:

- Safety films
- Demonstrations
- Posters
- Permission slips
- Safety rules
- Guest speakers
- Quizes/Tests
- Safety policy
- Bulletin boards
- Class discussions
- Student safety committee

OBJECTIVE #2: Students will participate in exploratory experiences which distinguish between renewable and non-renewable sources of energy.

Suggested Learning Activities:

- Construct models of windmills, waterwheels, solar hot water heaters, solar ovens, solar-heated houses.
- Visit electrical generating plants and local installation of renewable and non-renewable energy converters.
- View film/slide presentations that explain the different sources of energy.
- Convert small gas engine to alternative fuels (methane, alcohol, propane, etc.).
- Build a bio-mass converter.
- Construct a working solar hot water heater, solar collector for space heating, photovoltaic-powered device.
- Design and provide working drawings for a solar-heated facility (greenhouse, home, etc.).
- Build a wood stove or wood-fired hot water heater.

OBJECTIVE #3: Students will explore different methods of energy generation, storage, transmission, and conversion.

Suggested Learning Activities:

- Explore hydraulic/pneumatic systems.
- View related filmstrips/slide presentations.

- Make models of simple machines, electric motor kits, electric and CO_2 cars, series and parallel circuits, power plant layout, etc.
- Partially disassemble/assemble small gas engines, simple electro-mechanical devices, hydraulic/pneumatic tools or devices.
- Construct simple batteries.
- Take field trips to appropriate sites.
- Test different types of engines/motors on dynamometers.
- Construct gas-powered model airplanes, vehicles, etc.
- Hook-up a generator to a small gas engine and measure energy losses in conversion.
- Conduct a "static analysis" of a small gas engine.
- Perform reconditioning procedures on small gas engines.
- Research the case of turbo-chargers and superchargers for diesel and gas engines.
- Experiment with robotics and bionics technologies.

OBJECTIVE #4: Students will be made aware of the conservation of energy.

Suggested Learning Activities:
- View appropriate filmstrips/slide presentations on energy conservation in transporation, energy transmission, building construction, and manufacturing.
- Tour a home/building with an energy auditor.
- Construct or install a low-cost energy conservation device.
- Observe energy audit procedure using infra-red devices, blower doors, and computers/programs.
- Conduct a complete energy audit of a residence, a small commercial building, or sections of a school building.
- Construct a commercial-level energy conservation/retro-fitting device (eg: insulated shutters, solar panel, etc.).

OBJECTIVE #5: Students will explore electricity, electronics, power mechanics, and transportation technologies.

Suggested Learning Activities:
- Collage, bulletin board, models
- Design forms of transportation that do not rely on wheels
- View films and video tapes
- Field trips
- Debate pros and cons of the automobile as a form of transportation
- Construct, troubleshoot, assemble/disassemble, repair electronic circuits and devices (eg: appropriate kits and commercial/industrial materials).
- Construct series/parallel circuits, electric motors, testers, etc.
- Troubleshoot, disassemble, assemble, repair and conduct static analysis of small gas engine.
- Review basic automotive systems including ignition, lubrication, cooling, cranking and charging, transmission, suspension, brakes, drive train, carburetion, fuel injection, computer-assisted systems, the valve train and lower engine unit.
- Follow trade practices for basic maintenance operations for automobiles, including lube/oil/filter change, cooling

systems, ignition systems, and brake systems.
- Construct, operate, and maintain gas-powered model airplanes, rockets, CO_2 cars, and electric cars.
- Follow basic bicycle repairs/maintenance routines.
- Follow basic trade practices for the maintenance and repair of selected motorcycle systems.
- Study the movement/transportation modes for people and materials in different world cultures.
- Experiment with robotics and bionics technologies.

OBJECTIVE #6: Students will explore a number of energy sources being used to support families' life styles in this country, and assess the environmental impact of these energy sources.

Suggested Learning Activities:
- Complete an "energy inventory" of their home.
- Conduct a comprehensive energy audit of their home or residence.
- Provide a list of cost-effective energy-saving measures that will make their home/residence more comfortable and energy-efficient.
- Rank from most to least intrusive the environmental impact of renewable and non-renewable energy sources and major conversion systems.
- Trace the conversion of energy that results in powering typical small home appliances (e.g., toaster, air conditioner, microwave oven, light bulb, etc.).
- Read an electric meter.
- Calculate the BTUs (energy content) for different fuels (e.g., wood, alcohol, gasoline, fuel oil, propane, etc.)

OBJECTIVE #7: Students will explore the various forms of transportation.

Suggested Learning Activities:
- Compare efficiency of various forms of transportation (e.g., auto, airplane, train, ship).
- Calculate all costs for purchasing, maintaining, and operating vehicles, including taxes, insurance, etc., for 100,000 miles over a five-year period.
- Design an efficient transportation system for your town or city.
- Research Disney World/Disney Land as a prototype of an efficient, integrated transportation system.
- Determine how many HP is needed to propel a bike 20 mph (construct a bycycle dynamometer).

OBJECTIVE #8: Students will be exposed to career opportunities in Energy-Power-Transportation Technology and associated industries.

Suggested Learning Activities:
- View appropriate filmstrips/slide presentations.
- Visit, interview, or shadow a person employed in an energy-related industry.
- Construct a bulletin board, collage, or organizational chart that helps to describe job opportunities in energy-oriented industries.
- Organize career awareness days (guest speakers)

-PROGRAM ACCREDITATION AND TEACHER CERTIFICATION STANDARDS-

This Program Guide addresses fulfillment of the New Hampshire Standards for Industrial Arts curricula at the junior and senior high schools, as well as programs of teacher preparation in the state. These standards are presented in this section for reference.

STANDARDS & GUIDELINES FOR MIDDLE/JUNIOR HIGH SCHOOLS

State Department of Education, Concord, NH, October 1978

RATIONALE:

Industrial Arts is an important part of education for young people in our industrial society. It offers opportunities for all students to explore and develop basic understanding of the functioning and interdependence of individuals in our technological society. All need to understand the technical, occupational, recreational, organizational, managerial, social, historical and cultural aspects of our industry and technology. Students can develop competencies through problem-solving learning experiences which are based on skills of planning, designing, constructing and evaluating.

Exploring in industrial arts provides unique and relevant experiences which are particularly needed by early adolescents so that they can inventory and understand their own interests and special abilities related to educational and career plans. These skills and knowledge provide an effective basis for the resourcefulness necessary to succeed as a producer and consumer.

GOALS AND OBJECTIVES:

Students:

- Develop a measure of skill in the use of common tools and machines;
- Discover and develop their talents and interests in related areas;
- Build vocational skills and interests;
- Develop problem-solving skills related to materials and processes;
- Develop respect for work well done at any occupational level;
- Develop creative talents through the skills and media provided by industrial arts;
- Develop pride in workmanship, productivity and the ability to build or repair things;
- Increase resourcefulness as consumers and citizens through critical analysis of advertising and the maintenance of their own values;
- Develop self-fulfilling, recreational interests and activities;
- Develop insights and understandings of industry related to one's own economic, political and social structures and functions;
- Develop a safety consciousness that permeates all activity.

INSTRUCTIONAL FORMAT:

Instructional activities should be scheduled in blocks of time adequate for the laboratory and exploratory characteristics of the program. Attention should be directed to the personal, practical and recreational values of industrial arts.

Evident throughout experiences in the industrial arts laboratory should be:

- Respect for attitudes and practices of safety;
- Planning;
- Critical analysis of anticipated activities in relation to learner's capabilities;
- Knowledge of the use of materials in relation to the product;
- Cost accounting;
- An apparent meaningful use for each experience of the student.

CURRICULUM:

The curriculum should provide both boys and girls opportunities to explore a wide range of processes. In a general lab, several meaningful experiences can be provided simultaneously without designating a specific time for each. The movement from area to area will be indicated by the needs of the student, rather than by an inflexible schedule.

In order for students to understand something of manufacturing, construction, communications and transportation, the processes of planning, designing, organizing, construction, controlling, servicing and operating for production should be experienced by each student. These processes should involve manufacturing, construction, communications and transportation.

EVALUATION:

Evaluation in Industrial Arts relates directly to the objectives and is fairly easily developed since the degree of the acquisition of skills and knowledge is evident in the product produced.

With the planning of the project, the student determines with the teacher what standards and tolerances are acceptable and thus evaluates at each step as well as the final product.

STANDARDS FOR APPROVAL OF NEW HAMPSHIRE PUBLIC HIGH SCHOOLS
Grades 9-12, New Hampshire State Department of Education, December 1984

2.4.10 INDUSTRIAL ARTS

Industrial arts education is the study of industry and technology and their effects on our society. It provides planned learning experiences which develop knowledge and skills related to energy and power, materials and processes, and visual communication technology.

2.4.10.1 Unit Requirements. The approved high school shall provide a balanced program of industrial arts education consisting of FOUR UNITS of credit with at least one unit of credit from each of the following areas:

ENERGY AND POWER includes: the study of the related industrial and technical information; careers and their requirements; and learning experiences that involve the theory, harnessing, and controlling of power, including sources, generation, conservation, transmission, and exploration in mechanical, electrical, pneumatic, and hydraulic power.

Instruction shall address at least one of the following topical areas:

electricity	transportation
electronics	alternative energy
power mechanics	energy conservation

MATERIALS AND PROCESS TECHNOLOGY includes: the study of the related industrial and technical information; careers and their requirements; learning experiences that involve the application and use of the various tools, machines, materials, and processes associated with wood, metals, and plastic and their properties and uses as they are fabricated into products.

Instruction shall address at least one of the following topical areas:

wood technology	metal working
woodworking	plastic technology
metal technology	

VISUAL COMMUNICATION TECHNOLOGY includes: the study of the related industrial and technical information; careers and their requirements; learning experiences that involve transmitting ideas or concepts through drafting, printing, photography, and electronic communication devices.

Instruction shall address at least one of the following topical areas:

drafting (drafting fundamentals, mechanical, engineering, architectural)
photography
graphic arts

2.4.10.2 General Program Objectives. Instructional content and learning activities shall be planned to enable students to:

- understand the factors of production (capital, labor, management) in relation to industrial organization and managerial rules;
- perform manipulative tasks and skills in specific machine and tool operations;
- plan, design, and produce jigs, fixtures, templates, and various products;
- think critically and constructively in supporting the individual and societal needs for productivity and protection of the environment and our resources; and
- analyze, research, and solve technological problems in a systematic and economically sound manner.

TEACHER EDUCATION STANDARDS

"Standard Procedures for Approving Professional Preparation Programs in New Hampshire." New Hampshire State Board of Education, May 1980 (3.510/612.10).

Teacher preparation programs are designed to educate and train knowledgeable and technically proficient Industrial Arts/Technology Education professionals. New Hampshire standards for certification of these practitioners are presented here for reference.

COMPREHENSIVE INDUSTRIAL ARTS

Industrial Arts is the program that provides instruction and activities to develop understanding about industry and technology. These include activities such as experimenting, designing, constructing, evaluating, and using tools, machines, materials, and processes; and activities that assist individuals in making informed and meaningful occupational/educational choices.

Standard 1: The program shall provide for the development of teacher competencies in each of the following clusters of industrial arts programming.

- Communication. Experiences concerned with the tools, materials, and processes used in the graphics industries (study of the technical aspects of printing, related occupations, management problems, and consumer-printing industry relationships).

- Energy, Power, and Transportation. Study of the technology involved in harnessing and controlling power, including its source, generation, and transmission, the use of powered devices, and instrumentation and control.

- Manufacturing. A study of the technological achievements concerned with contemporary methods and processes used in manufacturing articles for mass consumption. These studies shall be concerned with the industry, technology, and products derived from materials and processes such as ceramics, crafts, metals, plastics, textiles, and woods.

- Construction. The skills and practices concerned with methods and processes used in the fabrication and completion of a structure.

Standard 2: The program shall provide skills and experiences by integrating each of the following industrial arts areas throughout the four clusters identified in Standard 1.

- drafting;
- graphic communications;
- woods;
- electricity/electronics;
- metals;
- plastics;
- ceramics;
- power mechanics; and
- manufacturing.

Standard 3: The program shall provide for the study of the philosophy, principles, and methods of industrial arts in elementary, secondary, adult, and collegiate schools.

Standard 4: The program shall provide a knowledge of the historical development of technology and its impact on man and society.

Standard 5: The program shall provide prospective teachers with the opportunity to major in one of the cluster areas.

Standard 6: The program shall provide knowledge in future technology as related to the changing needs in industry.

Standard 7: The program shall insure that the prospective teacher demonstrates the correct and safe use of tools, methods, and processes utilized in all industrial arts programs.

INDUSTRIAL ARTS CLUSTERS

Certification in a cluster means a candidate would have the training and competencies necessary to teach only those subjects listed under each cluster.

Standard 1: The program will assure that the candidate has the following competencies.

a. Knowledge of safety about the correct use of tools, materials, and processes used in the cluster and the New Hampshire Safety Standards for Related Programs in Vocational, Technical, Indutrial Arts and Pre-Vocational Education.

b. Knowledge of philosophy, principles, and methods of industrial arts, including types of laboratories and manufacturing activities.

c. Knowledge of technology, its historical development, and its impact on man and society.

d. Knowledge of new and emerging technology related to the changing needs in industry; e.g., the computer.

Standard 2: The program will assure that the candidate has the competencies indicated in either Visual Communication Technology, Materials and Processes Technology, or Energy and Power Technology.

a. Visual Communication Technology is the study of industrial-technical information, careers and their requirements. It includes learning that involves transmitting ideas through drafting, printing, photography, and electronic communication.

Applying the theories and competencies to:

1. Drafting
   a. Drafting Fundamentals
   b. Machine Drafting
   c. Architectural Drafting
   d. Electrical Drafting

2. Graphic Arts

   a. Offset Lithography
   b. Screen Printing
   c. Line Photography
   d. Continuous Tone Photography
   e. Plate Making
   f. Typography

b. Materials and Process Technology is the study of industrial-technical information, careers and their requirements. It includes experiences that involve the application and use of the various tools, machines, materials, and processes associated with wood, metal, and plastic. In addition, it covers their properties and uses as they are made into more usable products.

   1. Knowledge of the basic properties of wood, metal, and plastic.

   2. Competencies in manufacturing and in construction using wood, metal, and plastic.

c. Energy and Power is the study of industrial-technical information, careers and their requirements. It involves experiences that include the theory, the harnessing, and the controlling of power. It includes studying the sources, generation, conservation, transmission, and exploration of mechanical, electrical, pneumatic, and hydraulic power.

   Knowledge of basic components and theories and their application to:

   1. Electricity

   2. Electronics

   3. Power Mechanics

   4. Transportation

   5. Alternative Energies

   6. Energy Conservation

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AMERICAN INDUSTRIAL ARTS STUDENT ASSOCIATION

The New Hampshire Industrial Education Association encourages and supports the development and expansion of American Industrial Arts Student Association (AIASA) chapters and programs. Activities are related to those suggested and outlined in this Program Guide. AIASA activities have improved the Industrial Arts/Technology Education program by offering an additional means of creating interesting and productive learning opportunities for the benefit of students. AIASA increases the opportunity for individual student participation and growth by developing qualities of leadership and responsibility in the organization and operation of the learning environment.

The Mission of the American Industrial Arts Student Association

The mission of AIASA is to provide students an opportunity to become involved with meaningful activities and experiences that prepare them to understand, contribute to, and live in a changing technical world.

GOALS OF AIASA

1. Students will have contact with industrial and technological personnel, resources and developments to acquire technological understanding, consumer knowledge, and competencies that lead to responsible citizenship and the productive use of leisure time.

2. Students will acquire democratic understanding and practice through leadership and followership activities.

3. Students will plan, organize and carry out worthy activities and projects which contribute to an improvement in, or service to, the school and/or community.

4. Students will use the free enterprise system to become aware of employment, or self-employment opportunities, and requirements for use in making career choices in determining their educational programs.

5. Students will be recognized for high standards of craftsmanship, scholarship and safety practices.

-ACKNOWLEDGEMENTS-

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REVIEW COMMITTEE

During the Spring of 1986, participants in a weekend workshop at Keene State College were asked to review, critique, and suggest alternatives to the content of a draft of this Guide. Their suggestions were incorporated into the final document and appreciation is expressed to the following:

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Robert Levin	Kingswood Regional High, Wolfeboro
Robert O. Martel	Parkside Junior High, Manchester
Richard E. Merrill	Rundlett Junior/Concord High, Concord
William Mousseau	Merrimack High, Merrimack
Richard Nye	Winnacunnet High, Hampton
Delmar Ogg	Keene State College, Keene
Stanley Ouellette	Berlin Middle, Berlin
Lynda Plunkett	Winnacunnet High, Hampton
Brian Race	Stevens High, Claremont
Dennis Rosolen	Lincoln-Woodstock Regional High, Lincoln
John Rysnik	Spring Street Junior High, Nashua
Timothy Sherman	Mascenic Regional High, New Ipswich
Edward Taylor	N.H. State Department of Education
James Walter	Elm Street Junior High, Nashua
Thomas Wheeler	Salem High, Salem
Eugene Whittemore	Merrimack High, Merrimack
Charles Wilder	Keene Junior High, Keene
David Wilkins	Ashland Junior-Senior High, Ashland
Glenn Wilson	Kingswood Regional High, Wolfeboro
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Communication Systems, David Faux, Earl D. Gates

Computer Aided Design, Kolan K. Bisbee, Thomas P. Davies, Betty Lou Herter, Richard W. Luce, James A. Williams

Computer Aided Manufacturing, Kolan K. Bisbee, Thomas P. Davies, Betty Lou Herter, Richard W. Luce, James A. Williams

Computer Applications, Kolan K. Bisbee, Thomas P. Davies, Betty Lou Herter, Richard W. Luce, James A. Williams

Computer Graphics, Kolan K. Bisbee, Thomas P. Davies, Betty Lou Herter, Richard W. Luce, James A. Williams

Creativity & Innovation, John E. Cooper, John Gagliardo, William Hanks, Harvey Kay, Pamela Jones-Strong, Thomas C. Lamond

Electronics/Audio, Howard Sasson, George Legg, Robert F. Caswell, James Goldstine, Joseph Sarubbi, Sandra P. Sommer, Bruce G. Kaiser

Electronics/Communications, Howard Sasson, George Legg, Robert F. Caswell, James Goldstine, Joseph Sarubbi, Sandra P. Sommer, Bruce G. Kaiser

Electronics/Digital, Howard Sasson, George Legg, Robert F. Caswell, James Goldstine, Joseph Sarubbi, Sandra P. Sommer, Bruce G. Kaiser

Energy Systems, Robert J. Ullery, Daniel A. Nelso , C. David Gierke, Theodore Rorick

Graphic Communications, David D. Faux, Earl D. Gates, Ronald Hindmarch, William Mulvey, Ronald Sorensen

History of Technology, Martin D. Collins, Vincent C. D'Ambrosio, Chet Perry

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Production (Research & Development), Jack Brueckman, Jr., William Waite, Clark W. Greene, Robert N. Jones, Dennis Kroon

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Technical Drawing (Architecture), Dennis Kroon, Michael DeAngelis, David Kelsey, Raymond A. Miller, Stuart A. Soman

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Inquiries concerning the content of this Guide may be addressed to:

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STANDARDS FOR PROGRAM APPROVAL OF NEW HAMPSHIRE TECHNOLOGY EDUCATION PROGRAMS

1. The Technology Education program shall be conducted according to an approved Local or Regional Technology Education Plan.

1.1 The program is based on a written curriculum approved by the local administration and advisory committee. Yes No

1.2 The program is in compliance with standards of approval for public schools. Yes No

2. Instructors shall participate in the development of the Local or Regional Technology Education Plan which will include objectives and learning activities for the program consistent with the New Hampshire Guide for Technology Education.

2.1 The instructor can provide documentation that classroom activities implement written curriculum. Yes No

3. Programs shall provide students with appropriate opportunities and experiences to assist them in advancing to the next level of their development.

3.1 The program content and learning activities are appropriate for Technology Education programs. Yes No

3.2 Concrete and abstract learning opportunities and experience are provided (laboratory, simulated experience). Yes No

4. Students shall be provided with the opportunity to learn leadership skills as an integral part of each Technology Education program through participation in role playing activities offered within the activities of Technology Education youth groups.

4.1 Name of recognized Technology Education Youth organization.

4.2 Provide documentation of how opportunities to learn leadership are provided. Yes No

5. Students shall be provided equal access to all programs.

5.1 Steps have been taken to develop and implement recruitment and admission procedures which assure equal access to male and females. Yes No

5.2 The program activities and curriculum materials are free from purposeful discrimination on the basis of sex, race color, national origin, handicap or age. Yes No

6. Services appropriate to the needs of special populations (disadvantaged and handicapped) shall be provided.

6.1 The instructor has participated in the development of an Individualized Plan for each student classified as handicapped, disadvantaged, or limited English proficient for whom he/she has a responsibility. Yes No

6.2 The Individual Plan is appropriately implemented for each person classified as handicapped, disadvantaged, or limited English proficient. Yes No

6.3 The instructor has been supplied with a copy of the IEP for for each person classified as handicapped, disadvantaged, or Limited English Proficient. Yes No

7. Each Technology Education program shall have a Technology Education Advisory Committee which meets at least two times annually.

7.1 The Technology Education program has an advisory committee which has met _____ times in the last twelve months.

7.2 A copy of the minutes are readily available through the instructor of the Technology Education program. Yes No

7.3 Evidence is readily available that the Technology Education advisory committee:

7.3.1 Assists in the development and improvement of the rationale and justification of the Technology Education program. Yes No

7.3.2 Participates in the planning and periodic review of the program's goals and objectives. Yes No

7.3.3 Establishes and maintains working relations between the program and the community. Yes No

7.3.4 Has as an ex-officio member, a teacher from the Technology Education program. Yes No

7.3.5 Has representatition from other related areas of the curriculum; i.e., math, science, etc. Yes No

7.3.6 Has representation from both sexes. Yes No

8. Career and vocational guidance shall be available to all students.

8.1 Career and Vocational Guidance service(s) are conducted so that all students are able to make objective decisions. Yes No

9. Program facilities shall meet student space requirements and Technology Education program objectives.

9.1 Classroom(s) are adequate to meet student space requirements and Technology Education program objectives.* Yes No

9.2 Laboratory(ies) adequately meet student space requiremen and Technology Education program objectives.* Yes No

9.3 Learning station(s) are adequate to meet student space needs and Technology Education program objectives.* Yes No

9.4 Instructional Space (i.e. office, storage) are adequate to meet student space requirements and Technology Education program objectives. Yes No

9.5 The facilities comply with the requirements of the appropriate regulatory agencies. Yes No

9.6 Facilities provide access for physically handicapped students (ANSI Standards for NH Barrier Free Code). Yes No

*as per 1975 New Hampshire School Building Guide

10. Program equipment shall meet student needs based on Technology Education program objectives.

10.1 Program equipment and tools meet the needs of students based on program objectives. Yes No

10.2 Program equipment and tools are modified when necessary to meet the needs of handicapped students. Yes No

11. Program supplies and materials shall meet student's needs based on Technology Education program objectives.

11.1 Program supplies meet the needs of students based on program objectives. Yes No

11.1 Program materials meet the needs of students based on program objectives. Yes No

12. Program and facilities shall comply the Safety Standards for Related Programs in Vocational Technical, Industrial Arts, and Pre-Vocational Education.

12.1 The Technology Education program is in compliance with ALL applicable Sections of the Safety Standards: Checklist Form MIS-41. Yes No

13. Instructors whall be certified according to the standards of certification established by the State Board of Education through the Office of Teacher Education and Professional Standards. Secondary instructors of Technology Education shall be certified in technical specialties or subject areas taught (for the purpose of this section Industrial Arts may be substituted for Technology Education).

13.1 Instructors are certified according to the standards of certification established by the State Board of Education through the Office of Teacher Education and Professional Standards. Yes No

13.2 Instructors of Technology Education specialities are certified in technical specialities or subject areas taught. Yes No

13.3 Technology Education staff in critical shortage areas are actively pursuing certification via Alternative 4 (Individual Professional Development Plan). Yes No

Standards this program is currently not in complicance with and recommendations for improvement:

A GUIDE FOR CHANGE ---

MAKING THE TRANSITION

FROM

INDUSTRIAL ARTS

TO

TECHNOLOGY EDUCATION

SECTION E

REFERENCES AND RESOURCES

FOR THE TRANSITION

TO TECHNOLOGY EDUCATION

Making the Transition from Industrial Arts to Technology Education

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Technology Activity Guide 1 and Guide 2, Glenn Listar, Delmar Publishers, 2 Computer Dr., Albany, NY, 1987, 232 pp. and 245 pp.

Technology and You, David L. Goetsch and John A. Nelson, Delmar Publishers, Inc., 2 Computer Drive, Albany, NY 12212-9985, (includes Teacher's Manual), 1988

Technology Education Curriculum Guide, Illinois State Board of Education, Department of Adult, Voc. and Technical Education, 100 First St., Springfield, IL 62777, 1984.

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Technology Education: A Description and Listing of Programs in Oklahoma, Roger Stacy, Oklahoma State Department of Vocational and Technical Education, 1500 West Seventh Ave., Stillwater, OK 74074-4264, 405-377-2000.

Technology Education in Pennsylvania-Program Guide, Lee Plempl, Industrial Arts Education Advisor, Bureau of Vocational and Adult Education, Pennsylvania Department of Education, 333 Market St, 6th Floor, Harrisburg, PA 17126-0333, 717-783-6592, 1988.

Technology Education In Your World, with Teacher's Guide, Michael Hacker and Robert A. Bardon, Delmar Pub., Inc., 2 Computer Drive, Albany, NY 12212-9985, 1988.

Technology for Tomorrow, Williams, Badrkhat, Dagget, South-Western Publishing Co., Cincinatti, OH, 1985.

The New Basic-Technology Education, Video Cassette Program, International Technology Education Association, 1914 Association Drive, Reston, VA 22091, 703-860-2100, 1988.

Reviews of Selected Technology Education Curriculums and Text Series

Discovering Technology-Communication, Jones, Ronald E. and Robb, Janet L., Orlando, FL, Harcourt Brace Jovanovich, 1986, 320 pages; available Student Activity Guide and Teachers Manual

Text providing indepth study of Communications Technology systems. In the 26 chapters a step by step introduction to Communications Technology is provided. This is an excellent example of a series being developed for use in Technology Education curriculum. This would be recommended for an advanced Technology course to follow an Introduction to Technology Course. Well written, the Activity Guide and Teacher's manual complement the text most effectively.

Exploring Technology Education, Donovan Bowers, et al., Mid-America Curriculum Consortium, 1500 West Seventh Ave., Stillwater, OK 74074-4364, 800-654-3988; Series includes separate volumes on Exploring Communications Technology, Exploring Energy, Power, and Transportation Technology, Exploring Construction Technology, and Exploring Manufacturing Technology, 1987

Five volume set provided to be inserted in loose leaf binders. Complete curriculum with, for each unit, statement of goals, performance objectives, information, activities, tests and answer sheets as well as transparency and duplicating master originals. Volume I is designed for Introductory Course in Technology Education with other volumes providing learning experiences in each of the four major Technology Systems (Communications, Energy/Power/Transportation, Construction, Manufacturing). Well designed materials particularly for the novice Technology Educator seeking specific "What do I teach?" materials.

Illinois Technology Curriculum Guide, Illinois State Board of Education; Dept. of Adult, Vocational and Technical Education; Research and Development; 100 North First St., Springfield, IL 62777, 1984

Complete Technology Education Curriculum Guide developed for implementation in the state of Illinois as grade 9 and 10 curriculum. Major units are developed in Communication, Energy Utilization, Transportation, and Production Technologies. Within each major unit are 7 topical outlines complete with goal statements, unit objectives, suggested activities, overhead/duplicating originals, and Student Learning Packet (one for each major Technology Unit).

Industry and Technology Education - A Guide for Developing Contemporary Industrial Arts and Technology Education Curriculum, Thomas Wright and Len Sherry, Te Technical Foundation of America, Industrial Arts and Technology Education Project, Lansing, IL, 1986, 252 pages.

Based on a common definition of Industrial Arts, "a comprehensive educational program concerned with technology -- its evaluation, utilization, and significance; with industry -- its organization, personnel systems, techniques, resources and products; and the social/cultural impact of technology"; and Technology "the knowledge and study of human endeavors in creating and using tools, techniques, resources, and systems to manage the man-made and natural environments for the purposes of extending human potential and the relationship of these to individuals, society and the civilization processes." This guide outlines model Technology Education Programs, Suggested class organizations, topic outlines, unit topics, suggested activities and complete taxonomies based on the Jackson's Mill project.

Industrial Technology Systems Handbook, Ohio Industrial Arts Association, Ohio State Department of Education, Room 1005, 65 S. Front St., Columbus, OH 43266-0308, 614-466-2211, 321 pages.

This systems handbook was developed for use in Technology Education (Industrial Arts) classes in the state of Ohio. A product of the Ohio Industrial Arts Association the handbook is divided into 6 sections providing: Rationale, Philosophy, Scope and Sequence, Introduction and Synthesis Courses; for Systems in Construction Technology, Manufacturing Technology, Communication Technology, and Energy/Power Technology. Each unit is developed with goal statement, objectives, activities, resources, suggested learning strategies, content and evaluation.

Living with Technology, Michael Hacker and Robert A. Bardon, Delmar Publishers, Inc., 2 Computer Drive, Albany, NY 12212-9985, 1988, 560 pages with available Teacher Guide.

The five major sections of this outstanding text; What is Technology?, Communications, Production, Energy, Power and Transportation, Looking into the Future; are divided among the books 16 chapters. In this colorful text the authors expand on their earlier work with the New York State Technology Education Curriculum (found in Technology in Your World - Delmar 1987). Each system is explained and student activities are presented with the supporting teacher guide organized to provide: background information, resources, activities and review of materials. All very well done with color pictures, charts and other graphics to explain each concept. The major difference in this text, over their earlier work, is the inclusion of student activities within the text. According to the their publisher, "you cannot have enough activities available."

Technology Activity Guide 1 and Guide 2, Glenn Listar, Delmar Publishers, 2 Computer Dr., Albany, NY, 1987, 232 pp. and 245 pp.

Two study guides developed for implementing Technology Education in grades 7 and 8. Very well done activity based units for immediate implementation in middle school program. Activities require minimal cost items and guides will interface most effectively within existing budgets.

Technology and You, David L. Goetsch and John A. Nelson, Delmar Publishers, Inc., 2 Computer Drive, Albany, NY 12212-9985, with Teachers Manual, 1987, 456 pp.

An early text following the New York Techology Curriculum model. Well done over all with pictures and illustrations of information. Perhaps not as completely developed as Living with Technology, but good supplemental materials to have on hand. Does provide a social studies orientation for those interested in a greater focus on the impact of technological actions on our lives as a core to their Technology Education Curriculum.

Technology for Tomorrow, Williams, Badrkhat, Dagget, South-Western Publishing Co., Cincinatti, OH, 1985, 406 pages

Beginning level text in Technology Education with 16 chapters in 5 sections. Provides competent overview of how technology has changed our lives over the years. Introduces the systems approach to study of technology and does good job of explaining the relationship of one system with another in teaching Technology. Strong classroom approach to infusing a model content of a Technology Education program. This text does provide a focus on specific topics versus a generalized study of each of the technological systems.

Selected Catalogs of Available Curriculum Materials for Implementing Technology Education

Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455; 800-322-3905

Delmar Publishers Inc., 2 Computer Drive West, Albany, NY 12212, 800-347-7707

Directory of Curriculum Guides and Other Key Resources, International Technology Education Association, 1914 Association Drive, Reston, VA 22091, 703-860-2100

Extension Instruction and Materials Center, The University of Texas at Austin, PO Box 7218, Austin, TX 75713-7218, 512-471-7716

Fischer America, Inc., 175 Route 46 West, Fairfield, NJ 07006, 201-227-9283

LEGO Educational Department, Attn. Sarah MacDonald, PO Box 39, Enfield, CT 06082, 800-527-8339

National Center for Research in Vocational Education, The Ohio State University, Columbus, OH 43210, 800-848-4815

Mid-America Vocational Curriculum Consortium, 1500 West Seventh Ave., Stillwater, OK 74074-4364, 800-654-3988

Technology Education Software Bank, Attn. Paul E. Post, 190 West 19th Ave., Columbus, OH 43210-1184, 814-292-7471

Transtech Systems, Div. of Creative Learning Systems, Inc., 9889-E Hibert St., San Diego, CA 92131, 619-566-2880 or 2882

Unilab, Inc., PO Box 837, Manassas Park, VA 22111

A GUIDE FOR CHANGE ---

MAKING THE TRANSITION

FROM

INDUSTRIAL ARTS

TO

TECHNOLOGY EDUCATION

SECTION F

TRANSITION TO

TECHNOLOGY EDUCATION

PROJECT INFORMATION

Making the Transition from Industrial Arts to Technology Education

Technology Education (Industrial Arts) Teacher Attitude Survey

A survey of the Industrial Arts Teachers in New Hampshire was conducted to identify the concerns of teachers relative to a "focus" shift from traditional Industrial Arts programming to Technology Education. Responses were received from 37% (112 of 296) of those teachers. Presented here is a summary of the imformation gathered by question indicating the percentage of responses (raw scores are indicated within the brackets).

1. In your school which grades may take Industrial Arts? 5-1% (9); 6-23% (25); 7-64% (72) 8-65% (73); 9-71% (80); 10-71% (79); 11-71% (79); 12-71%(79)

2. What is the enrollment of your school? 1-200 201-500 501-1000 1001+
4% (4) 22% (24) 43% (47) 32% (36)

3. Are you aware of the shift in focus that Industrial Arts is making to Technology Education throughout the United States? YES 86% (96) NO 14% (16)

4. Do you understand that this shift in focus from Industrial Arts to Technology Education is more than a name change, but a different approach to facilitating the career development of students? YES 76% (85) NO 24% (27)

5. Are you interested in learning more about this shift in focus from Industrial Arts to Technology Education? YES 96% (107) NO 4% (5)

6. Do you believe that there is a need in your school to modify your curriculum in Industrial Arts to reflect the change in focus to Technology Education?
YES 80% (89) NO 20% (23)

7. Rank order the following "difficulties in the implementation of curriculum change" with 1 the least difficult to 5 the most difficult (scores divided by responses):

3.6 ___Time involved to research and develop curriculum
2.9 ___Lack of available information about new/innovative curriculum
3.6 ___Expense of implementing curriculum change
2.3 ___Relevance of new curriculum to the needs of the learner
2.4 ___Administrative support for curriculum change
(indicate level in order)
1.5 ___Principal 2.0 ___Superintendant 2.4 ___School Board

8. Are you interested in learning how you might change the focus of your Industrial Arts Curriculum to reflect a change in focus to Technology Education?
YES 88% (98) NO 12% (15)

93% (104 of 112) of those responding included their name and address.

New Hampshire Schools Responding to the Transition To Technology Survey

Alton Central School	Alton	Fred Ayer Jr.
Alton Central School	Alton	Alexander Brunell
Alvirne High School	Hudson	Clyde Collishaw
Alvirne High School	Hudson	Ron Jarvis
Alvirne High School	Hudson	George Cook
Ashland High School	Ashland	David Wilkins
Barrington Middle School	Barrington	Ernie Burkhardt
Belmont High School	Belmont	John Frick
Belmont High School	Belmont	Glen Traquair
Berlin High School	Berlin	Annette Cochran
C.D. McIntyre School	Whitefield	Ervin Connary
Conval High School	Peterborough	Ed Gierty
Elm St. JHS	Nashua	David Purington
Elm St. JHS	Nashua	Rena LaTouche
Exeter Area JHS	Exeter	Dana Wyman
Fall Mountain Reg HS	Alstead	Daphne Berntsen
Gilford Mid-HS	Gilford	Ken Ellis
Goffstown High School	Goffstown	Dave Pearson
Goffstown High School	Goffstown	Richard Wood
Goffstown Jr-Sr HS	Goffstown	John H. Greene
Hampton Academy JHS	Hampton	Thomas Liddy
Hanover High School	Hanover	Richard Saturley
Haverhill Academy JHS	Haverhill	Carlos W. Cutler
Hillsboro-Deering HS	Hillsboro	Donald Brown
Hollis High School	Hollis	G. Wilkins
Indian River School	West Canaan	Jay Davis
Inter-Lakes High School	Meredith	Paul Beaudoin
Inter-Lakes High School	Meredith	Timothy B. Beach
J. Mastricola Mid. Sch.	Merrimack	Neil Geary
Jaffrey-Rindge School	Jaffrey	Randy Blodgett
Jaffrey-Rindge Middle Sch	Jaffrey	Michael Bennett
John Stark Reg. Sch.	Weare	Jane Zirbe
Kearsarge High School	North Sutton	Robert Ragazzo
Keene High School	Keene	Howard Mumphrey
Keene High School	Keene	Wayne Cotton
Keene High School	Keene	Robert Mackerott
Keene Jr. High School	Keene	Charles F. Wilder
Keene Jr. High School	Keene	James Hurley
Keene Junior High School	Keene	Robert Austin
Kingswood Reg. HS	Wolfeboro	Robert E. Levin
Kingswood Reg. HS	Wolfeboro	John Aron
Kingswood Regional JHS	Wolfeboro	Greg F. Heope
Laconia High School	Laconia	Roger Fournier
Laconia High School	Laconia	Scoot Belliveau
Lancaster Elem	Lancaster	Wayland Nutting
Lebanon High School	Lebanon	L.W. Fisk
Lebanon Jr. High School	Lebanon	Edward Frazier
Linwood High School	Lincoln	Dennis Rosolen
Littleton High School	Littleton	Mark Humphreys
Londonderry High School	Londonderry	Anthony Hannon
Londonderry High School	Londonderry	Stephen Schirmer
Londonderry High School	Londonderry	Tom Diccarello
Marlborough School	Marlborough	Holly Stetson
Mascoma High School	Canaan	[illegible]
Mascoma Valley Regl HS	Canaan	Dan Huntley
Mastricola Middle School	Merrimack	S. DeCloedt
Mckelvie Middle School	Bedford	Dan Caron
Mckelvie Middle School	Bedford	Raymond Ross
Memorial High School	Manchester	Peter Panagos
Memorial High School	Manchester	J.G. Diamantis
Memorial High School	Manchester	Allen Swiesz
Merrimack High School	Merrimack	Lawrence Brown
Merrimack High School	Merrimack	Ralph Dwire
Milford Area Sr. HS	Milford	Pierre Couture
Milford Area Sr. HS	Milford	Victor H. King
Monadnock Reg. HS	Swanzey	Ray Dunn
Nashua High School	Nashua	Scott Goodell
Nashua High School	Nashua	Greg Fletcher
Newmarket Jr-Sr HS	Newmarket	Paul Cuetara
Newport Jr-Sr HS	Newport	Marshall Barrett
Nute Jr-Sr High School	Milton	Tom Mulligan
Orford High School	Orford	Barry LeBarron
Oyster River Mid. Sch.	Durham	Alan C. Stewart
Parkside JHS	Manchester	Robert Martel
Parkside JHS	Manchester	Herb Horner
Pelham High School	Pelham	John Gordon
Pelham High School	Pelham	Fred W. Hale
Pemoroke Academy	Suncook	Leon Frechette
Peterborough Middle Sch	Peterborough	Howard Robertson
Pinkerton Academy	Derry	Rich Talbot
Pinkerton Academy	Derry	Rolfe Voltaire
Pinkerton Academy	Derry	John Rabidoux
Pittsburg School	Pittsburg	Lamuel Miller
Pittsfield Middle/High Sch	Pittsfield	Evan M. Benson
Pittsfield Middle/High Sch	Pittsfield	Dan Hoffman
Portsmouth Sr. HS	Portsmouth	Scott Darling
Portsmouth Sr. HS	Portsmouth	Robert Carolyn
Raymond High School	Raymond	William R. Brett
Rundlett JHS/Concord HS	Concord	Richard Merrill
Salem High School	Salem	Marshall Derry
Sanborn Middle School	Newton Jun.	Matthew Simpson
Sanborn Reg. HS	Kingston	Steve Kossakoski
Sanborn Reg. HS	Kingston	Michael Hawes
Somersworth High School	Somersworth	Robert Crighton
Southside JHS	Manchester	Arthur Panagos
Spaulding Jr. High	Rochester	John Miller
Stevens High School	Claremont	Bob MacDowell
Stevens High School	Claremont	John Caramore
Thayer High School	Winchester	Dale Courtney
Timberlane Regional JHS	Plaistow	Peter D. Luna
West High School	Manchester	Calvin W. Elliott
White Mountains Reg. HS	Whitefield	Robert Ross
Winnacunnet High School	Hampton	Richard Nye
Winnisquam Reg. Sch.	Tilton	Douglas Howes
Wilton-Lyndeboro Coop.	Wilton	B. Wheeler
Woodbury JHS	Salem	Steve Shute
Woodbury HS	Salem	S.H. Shepard

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New Hampshire Schools Involved in the Transition to Technology Project

Each of the following schools actively participated as a test site during this project's duration. Schools were selected based on their evidenced interest to take part in this effort, with consideration given to size of school, geographical location, and grades taught. They contributed by providing a means for the director to identify concerns and share information gathered as a part of the project. Also, they participated as validators of the materials as developed during the project.

Keene Jr. High School, 17 Washington St., Keene, NH 03431, Charles Wilder, Technology Teacher, 603-352-5830.

Linwood High School, Main St., Lincoln, NH 03251, Dennis Rosolen, Technology Teacher, 603-745-2214.

Manchester Parkside JHS, Blucher St., Manchester, NH 03102, Robert Martel, Technology Teacher, 603-624-6356.

Manchester West High School, 9 Notre Dame Ave., Manchester, NH 03102, David Elliott, Technology Teacher, 603-624-6388.

McKelvie Middle School, 108 Liberty Hill Rd., Bedford, NH 03102, Dan Caron, Technology Teacher, 603-472-3951.

Newmarket Jr-Sr High School, South Main St., Newmarket, NH 03857, John Williams, Principal, 603-659-3271.

Nute Jr-Sr High School, Elm St., Milton, NH 03851, Tom Mulligan, Technology Teacher, 603-652-4591.

Somersworth High School, Memorial Dr., Somersworth, NH 03878, Brian Beeler, Vocational Director, 603-692-2431.

State Department of Education, 101 Pleasant St., Concord, NH 03301, Roland Cournoyer, Curriculum Supervisor, 603-271-3186.

Portsmouth Senior High School, Alumni Dr., Portsmouth, NH 03801, Scott Darling, Technology Teacher, 603-436-7100 x229.

Rundlett Jr High/Concord High School, Conant Park Dr., Concord NH 03301, Richard Merrill, Technology Department Chair, 603-225-0864.

Winnacunnet High School Alumni Dr., Hampton, NH 03842, Richard Nye, Technology Department Chair, 603926-5561

Interviews Conducted in Duration of Project

(In many cases individuals were interviewed more than once, with only initial date and time indicated)

Robert Austin, Technology Teacher, Keene JHS, Keene, NH, Oct 27 87, 9:00 AM
Brian Beeler, Director of Vocational Education, Somersworth High Sch., Somersworth, NH, Apr 14 88, 10:00 A
Dr. Keith Blankebaker, Assoc. Prof Dept of Ed Theory and Practice, The Ohio State University, Columbus, OH, Nov 18 87, 12:00 PM
Lon Briggs, Industrial Arts Dept., Westland HS, Galloway, OH, Nov 19 87, 10:00 AM
Sam Bruno, Student Services Director, Region 18 Voc., Exeter, NH, Mar 15 88, 8:30 AM
Brian Buckley, Principal, Lincoln Akerman Sch., Hampton Falls, NH, Nov 12 87, 9:00 AM
Kevin J. Burns, Consultant, Bowling Green SU, Bowling Green, OH, Nov 17 87, 10:00 AM
Richard Bray, President-Elect ITEA, Practical Arts Dept. Chair, Oak Hill High School, Sabbatus, ME, Jan 26, 88, 1:30 PM
Frank Cappelle, Director Ctr. for Technology Education, Trenton, NJ Jan 22 88, 1:00 PM
Daniel Caron, Ind. Arts Teacher, McKelvie School, Bedford, NH, Sep 16 87, 1:00 PM
Dr. William Cavanaugh, Chair Industrial Technology Dept., Rhode Island College, Providence, RI, Nov 3 87, 10:30 AM
Wayne Cotton, President NHIEA, Concord, NH, Sep 9 87, 4:00 PM
Roland Cournoyer, Industrial Arts Consultant New Hampshire, NH State Dept. of Ed., Concord, NH, Sep 10 87, 9:00 AM
Scott Darling, Tech. Teacher, Portsmouth SHS, Portsmouth, NH, Mar 15 88, 2:00 PM
Tom Dickinson, Technology Department Chair, Sewell, NJ, Jan 21 88, 6:00 PM
Tom Duda, Tech. Teacher, Plymouth Area High Sch., Plymouth, NH, Apr 14 88, 1:00 PM
Ralph Dwire, Chair Ind. Arts, Merrimack High Sch., Merrimack, NH, Mar 3 88, 10:00 AM
Dave Elliott, Technology Teacher, West High School, Manchester, NH, Mar 9 88, 2:00 PM
William Ewert, Chief Bureau of Educational Services, NH State Dept. of Education, Concord, NH, Mar 17 88, 11:00 AM
Charles Foley, Principal, Concord High School, Concord, NH, Oct 8 87, 11:30 AM
Dr. Richard Foley, Industrial Education Teacher Educator, Keene State College, Keene, NH, Oct 27 87, 2:00 PM
Richard Goodman, Executive Director, Center for Educational Field Services, Durham, NH, Apr 14 88, 10:00 AM
Charles Graham, Technology Department Chair, Sewell, New Jersey, Jan 21 88, 6:00 PM
Eugene Hawley, Principal, Winnacunnet High School, Hampton, NH, Oct 6 87, 10:30 AM
John Holmes, Director of Vocational Education, White Mountain Reg. HS., Whitefield, NH, Apr 7 88, 1:30 PM
Dr. John Hutchinson, Director Center for Technology, Sewell, NJ, Jan 21 88, 6:00 PM
Dr. Patricia Hutchinson, Asst. Director Center for Technology Education, Sewell, NJ, Jan 21 88, 6:00 PM
Robert Ingalls, Industrial Arts, Department Chair, Mount Ararat High School, Topsham, ME, Jan 26, 88, 10:00 AM
Bud Johnson, Vice-President, Paxton-Patterson, Sewall, NJ, Jan 21 88, 6:00 PM

Dr. Ronald Jones, Professor of Tech. Ed., Bowling Green SU, OH, Nov 17 87, 10:00 AM
Steve Jones, Vocational Director, Concord High Sch., Concord, NH, Oct 8 87, 10:00 AM
Joseph Keinberger, Assistant Senior Personnel Manager, Stone and Webster Engineering Corporation, Boston, MA, Jan 6 88, 9:00 AM
Francis H. Kucharski, Manager Automated Methods, Information Technology Division, Stone and Webster Engineering Corporation, Boston, MA, Jan 6 88, 10:00 AM
Kenneth Latchaw, Vocational Director/Industrial Arts Coordinator, Dover High School, Dover, NH, Oct 2 87, 11:10 AM
George A. Marsden, Assistant Manager, Reprographics Department, Stone and Webster Engineering Corporation, Boston, MA, Jan 6 88, 1:30 PM
Robert Martel, Tech. Teacher ,Parkside JH Sch., Manchester, NH, Mar 9 88, 10:30 AM
Peter McClure, Vermont State Consultant Industrial Arts/Technology Education, White River Junction, VT, Oct 27 87, 5:00 PM
Richard Merrill, Technology Education/Industrial Arts Dept., Chair, Rundlett Jr. High School, Concord, NH, Mar 18 88, 2:00 PM
Marilyn Monohan, President NEA-NH, North State St., Concord, NH, Mar 17 88, 9:00 AM
Tom Mulligan, Technology Teacher, Nute J-S HS, Milton, NH, Mar 18 88, 10:00 AM
Langdon Plumer, Voc- Dir, Region 18 Voc. Center, Exeter, NH, Sep 24 87, 10:00 AM
William Porter, Chief Bureau of Vocational-Technical Education, NH State Dept. of Education, Concord, NH, Feb 26 88, 1:00 PM
Paul Post, Asst Prof., The Ohio State University, Columbus, OHNov 18 87, 1:30 PM
Gordon Quimby, Prin., North Hampton Elem. North Hampton, NH, Sep 19 87, 1:00 PM
Dennis Roselyn, Tech. Teacher, Linwood Jr-Sr HS, Lincoln, NH, Mar 4 88, 10:00 AM
Dr. Eugene Ross, Superintendent of Schools, Manchester, NH, Sep 10 87, 1:00 PM
Kjell-Jon Rye, Tech Educator, Bellevue, Washington, Norfolk, VA, Mar 23, 88, 10:00 AM
Ernest Savage, Professor of Technology Education, Bowling Green State University, OH, Nov 17 87, 9:00 AM
Dr. Richard Schwab, Assistant Professor of Education, Morrill Hall, UNH, Durham, NH, Oct 7 87, 9:30 AM
Dr. Jay Smink, Director of Research, National Center for Research in Vocational Education, Sep 2 87, 2:00 PM
Dr. Kendall Starkweather, Executive Director, ITEA, Sewell, NJ, Jan 21 88, 6:00 PM
Holly Stetson, Tech Teacher, Marlborough Elem. , Marlborough, NH, Oct 27 87, 8:30 AM
Dr. Jerry Streichler, Technology Education Dept. Chair, Bowling Green SU, OH, Nov 17 87, 11:15 AM
Dr. Ronald Todd, Professor of Communications and Technology, New York University, New York, NY, Jan 21 88, 1:00 PM
Robert Vorac, Tech. Teacher, Dublin Middle School, Dublin, OH, Nov 19 87, 1:00 PM
Dr. Kenneth Webber, Vocational Director/Industrial Arts Coordinator, Portsmouth HS, Portsmouth NH, Sep 30 87, 10:35 AM
Dr. Jack Wescott, Director of Professional Development, Fitchburg State College, Fitchburg, MA, Oct 26 87, 9:30 AM
Charles Wilder, Tech. Teacher, Keene Junior High Sch., Keene, NH, Oct 27 87, 9:00 AM
Dr. Mike Williams, Industrial Arts Dept. Chair, Central Connecticut State University, New Britain, CT, Nov 2 88, 11:00 AM